

The Nation's Water Resources

The Second National Water
Assessment by the
U.S. Water
Resources Council

Part V Regional Assessment Summaries

April 1978



U.S. Water Resources Council 2120 L Street, N.W. Washington, D.C. 20037



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PART V
REGIONAL ASSESSMENT SUMMARIES



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FOREWORD

The United States Water Resources Council was established by the Water Resources Planning Act of 1965 (P.L. 89-80) to maintain a continuing study and issue periodic reports on the Nation's water resources and their ability to meet present and future requirements. The results of the First National Water Assessment were issued by the Council in 1968 in The Nation's Water Resources. The First Assessment placed in a national perspective the estimates of present and future water and related land supplies and requirements of the Nation's water resources regions.

The Council initiated the Second National Water Assessment in October of 1974. In the analysis of the data the base year is 1975 and projections are made for 1985 and 2000. The United States has 21 water resources regions which for the purposes of the Second National Water Assessment were divided into 106 subregions. Comprehensive data and information were developed for each subregion. The subregion concept is to have one basin or a group of basins for which data could be collected and compiled.

Data collection and development of information for this report were conducted in three major phases: Phase One, Nationwide Analysis; Phase Two, Specific Problem Analysis; and, Phase Three, National Problems Analysis.

The Nationwide Analysis was conducted by Council member agencies and reflects their view of existing and future water requirements, the nature of problems, conflicts associated with efforts to meet the requirements, and implications for the future.

The Specific Problem Analysis was conducted on behalf of the Council by a regional entity in each of the 21 water resources regions. Each entity was comprised of a study team of representatives from state and Federal agencies. The Specific Problem Analysis viewed resource conditions and problems from a state-regional perspective.

The National Problems Analysis used the results of Phases One and Two to assess national problems for presentation in this report. The format is to present an overview of water resource management problems at the national, regional, and subregional level of detail.

An important feature of the Second National Water Assessment is that it presents a general "water balance" analysis for each of the 106 subregions. In these analyses the location and scope of critical water quantity, quality, and related land problems are indicated, as well as basic information needed for water and land management policies and programs.

The Nation's Water Resources, the final report of the Second National Water Assessment, is based on many reports and special studies. The Nationwide Analysis was documented in a summary report and 14

supporting appendices. The Specific Problem Analysis was documented by three published reports prepared by the 21 regional study groups; the State/Regional Future Report, Effect of Not Resolving Problems, and Summary Report.

The Nation's Water Resources includes the following parts and appendices:

Summary Report

Part I Introduction

Part II Water Management Problem Profiles

Part III Functional Water Uses

Part IV Water Supply and Water Quality Considerations

Part V Regional Assessment Summaries and Regional Reports

Appendix A-1 Economic, Social, and Environmental Data

Appendix A-2 Water Supply and Use Data

Appendix A-3 Water Supply and Use Analyses

Appendix A-4 Streamflow Conditions

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INTRODUCTION

Part V of the Second National Water Assessment is composed of summaries of the 21 Regional Assessment Reports which were developed by the Regional Sponsors during the Specific Problem Analysis phase of the Assessment process. The Regional Reports present social, environmental, and economic data and information, discuss functional and location-specific water problems, and provide state-regional recommendations focusing on planning, research, data collection, and institutional needs. For easy reference the material for all 21 sections of Part V is arranged in the following sequence:

- Map of Region With Aggregated Subregion Delineations
- Highlights
- Comparative Analysis - Data Summary Table
- Problem Area Map - List of Problem Areas
- Occurrence of Problem Issues by Aggregated Subregion and Problem Area

Condensed in the "Highlights" section of each regional summary are those portions of the Regional Reports pertaining directly to water concerns. The "Highlights" section contains a brief statement about the land area, major river systems, and overall water supply situation in each Region. A synopsis is presented of the major water-related problems and issues and general conclusions and recommendations which are discussed in detail in the Regional Reports.

The "Comparative Analysis" section of each of the 21 summaries presents a comparison of the State-Regional Future (SRF) and National Future (NF); these two separate sets of data were developed by State-Regional entities and Federal entities, respectively. Part V is the only part of the Second National Water Assessment which presents estimates of physical and socio-economic data based on state-regional goals and objectives. The projected data and the nature and magnitude of problems perceived from the regional viewpoint are often at variance with those of the National Future or the Federal perspective.

The Regional Reports from which much of the material in this Part was drawn were developed from Technical Memoranda prepared by State and regional study participants under contractual arrangement with the Water Resources Council. The four Technical Memoranda developed during the Specific Problem Analysis include: Technical Memorandum 1, a compilation of regional, state, and local resource issues as perceived by state, local, and Federal agencies; Technical Memorandum 2, which consists of regional resource goals and policies and related future needs and the identification of severe water and related land resource problems; Technical Memorandum 3, which is divided into two parts: the effects of not resolving resource problems and the programs available to help resolve selected resource problems; and Technical Memorandum 4, which formulates recommendations for the resolution of the Region's resource problems and provides a summary of the previous 3 Technical Memoranda.

NEW ENGLAND REGION

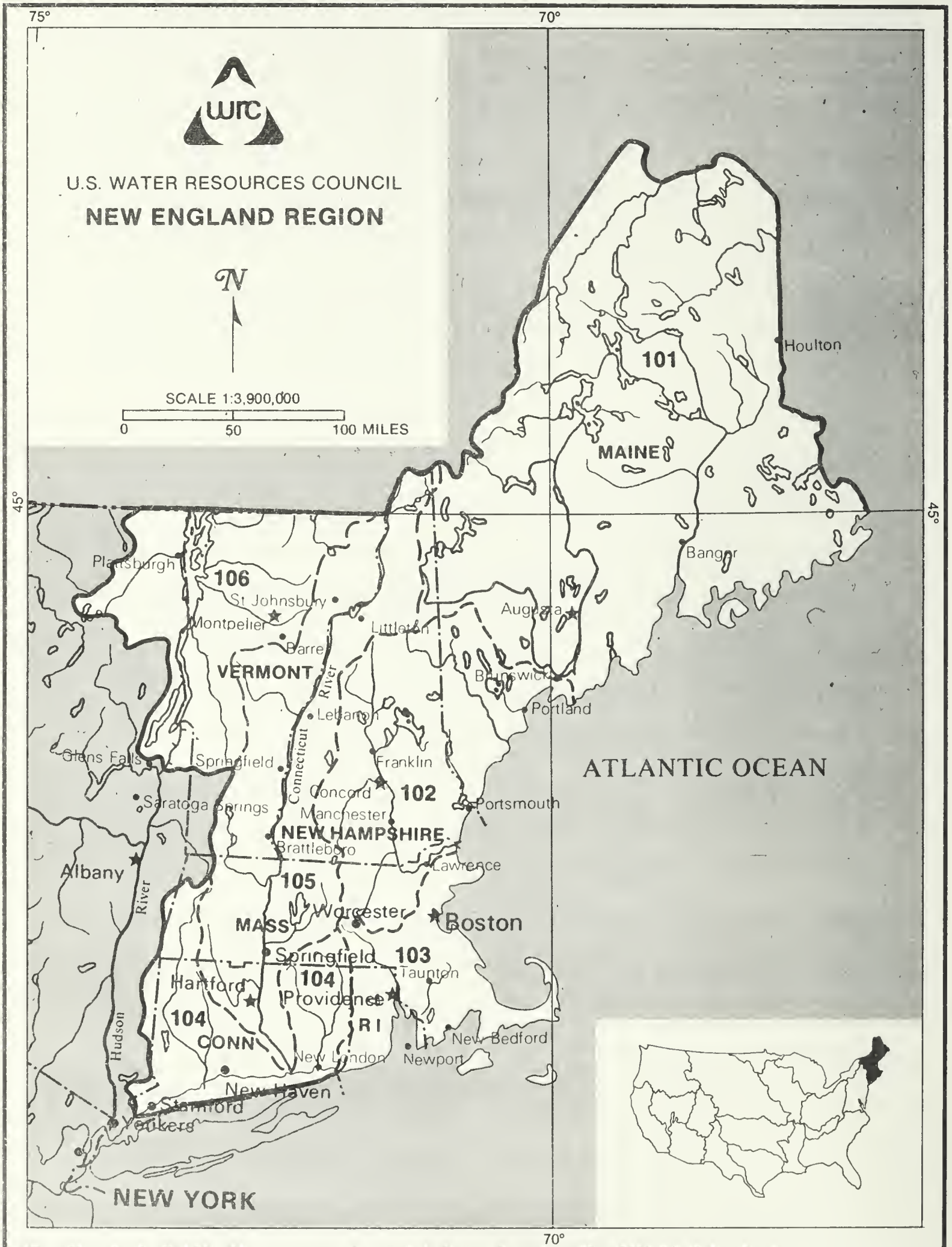


FIGURE V- I

THE NEW ENGLAND REGIONHighlights

- The New England Region contains about 69,000 square miles encompassing slightly over 2 percent of the nation's land area. The Region's abundant water resources, 30 thousand miles of streams, more than 5,000 lakes, and 6,000 miles of coastline, include New England's largest single basin, that of the Connecticut River. Most of the rivers in the New England Region flow in a generally southerly or south-easterly direction toward Long Island Sound or the Atlantic Ocean. Exceptions are the Saint John River and the Lake Champlain and Lake Memphremagog drainages.
- Overall the Region appears to have adequate water and related land resources to provide for future generations. However, because continuous settlement in urbanized areas has placed quantitative and qualitative stress on local resources, scarcity due to maldistribution of resources and poor water quality does occur at the local level. The potential for severe water supply shortages is substantial, especially if water sources are not protected and managed wisely.
- Industry accounts for the largest portion of consumptive water use.
- New England faces problems of water pollution, local flooding, insufficient water supplies, energy facility siting, dredging impacts, inadequate

water-based recreation opportunities, and conflicts over use of water and related lands. The severity of most problems intensifies near metropolitan areas, especially since many urban areas are located at points where surface water flows cannot assimilate accumulated waste products from upstream. The problem of discrepant distribution of resources within the Region involves major specific issues including proposed inter-basin diversions from the Connecticut River Basin to Boston, land use controls, and oil and gas reserves development on George's Bank. Distribution of high quality water resources, in sufficient quantity to provide for domestic, industrial, and agricultural needs, and the allocation of land to uses appropriate both to economic growth and to intrinsic environmental capabilities, are the primary challenges facing the New England Region in the near future.

- Twenty-two geographic problem areas are identified (see Figures V-2 and V-3).
- The New England Regional Sponsor proposes a set of objectives designed to achieve an overall strategy for the resolution of its resource issues and suggests ways to implement them. Recommendations are outlined for water quality, water supplies, flooding and wetland destruction, erosion and sedimentation, low streamflows and fluctuating lake levels, inadequate water-oriented recreation, energy facility siting, and coastal petroleum development and transportation using three approaches: data collection and research; planning studies; and legal, institutional, and policy changes. (For more detail see the New England Regional Report).

Comparative Analysis

Table V-1 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows and water needs in the New England Region. In many cases it has been necessary to adopt the National Future information as New England's State-Regional Future. This use should not imply full review and acceptance of the National Future data, but instead reflects the lack of state information on an Aggregated Subregion basis. The "information gap" revealed in some of the resource categories is being addressed through state data collection programs. As it becomes available, more precise information will be incorporated into the ongoing assessment and basin planning programs. However, the Aggregated Subregions are not now appropriate geographic units in the context of most state resource programs.

Values for streamflow at the outflow point in Table V-1 represent the estimated streamflow of the Region in an average year under present and future conditions of consumptive use, imports, exports, and reservoir evaporation. The slight difference between SRF and NF is attributed to differing population estimates.

The NF and SRF are in agreement for withdrawal and consumption estimates.

Table V-1

THE NEW ENGLAND REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	12,492	12,380	13,613	13,442	15,313	14,965
Total Employment	5,460	5,460	6,204	6,204	7,209	7,209
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s)	78,140	77,870	77,975	NE	77,560	NE
Freshwater Withdrawals	5,094	5,099	3,935	3,937	3,231	3,236
Agriculture	53	57	60	60	65	65
Steam-Electric	1,263	1,263	1,069	1,069	375	375
Manufacturing	2,169	2,169	1,022	1,022	783	783
Domestic	1,122	1,122	1,223	1,222	1,356	1,358
Commercial	361	361	393	393	442	442
Minerals	90	90	115	115	153	153
Public Lands	1	2	1	4	2	5
Fish Hatcheries	37	37	55	55	55	55
Other	0	0	0	0	0	0
Freshwater Consumption	480	484	644	646	1,059	1,062
Agriculture	43	46	48	48	52	52
Steam-Electric	21	21	18	18	167	167
Manufacturing	192	192	331	331	563	563
Domestic	164	164	179	178	196	196
Commercial	48	48	52	52	58	58
Minerals	11	11	16	16	20	20
Public Lands	1	2	1	4	2	5
Fish Hatcheries	0	0	0	0	0	0
Other	0	0	0	0	0	0
Ground Water Withdrawals	635	664	NE	NE	NE	NE
Reservoir Evaporation	0	0	0	0	0	0
Instream Approximation						
Fish and Wildlife	69,001	69,001	69,001	69,001	69,001	69,001

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

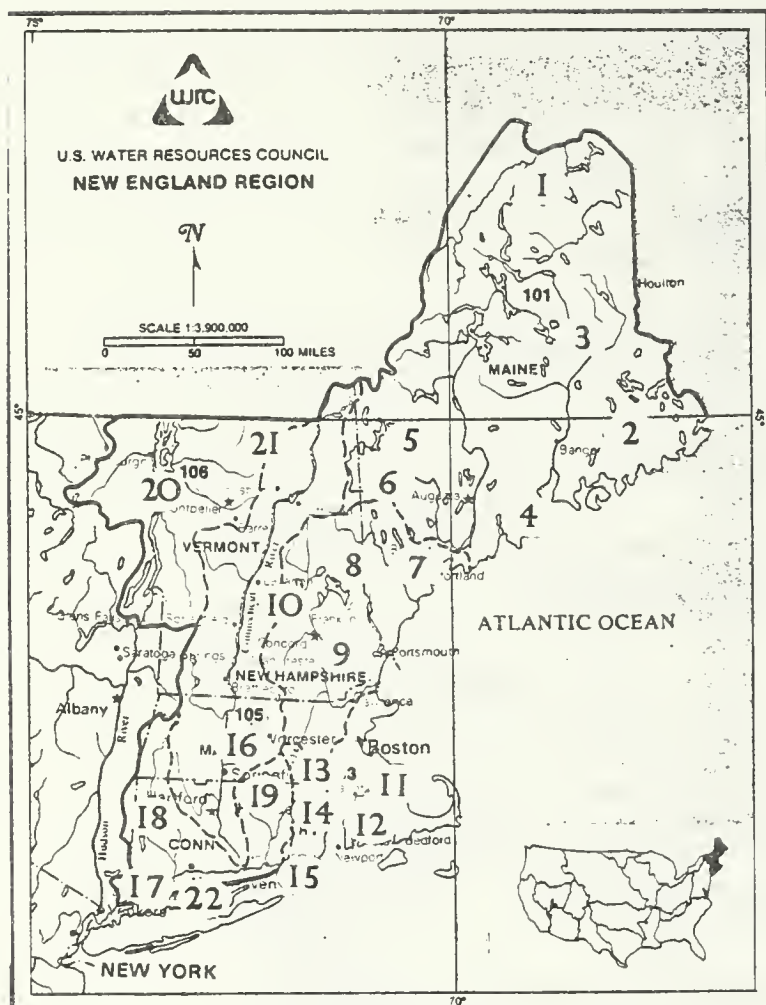
Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



NEW ENGLAND REGION

PROBLEM AREAS

- | | |
|--|--|
| 1. St. John River Basin | 12. Narragansett Bay |
| 2. St. Croix and Maine Eastern Coastal | 13. Blackstone River Basin |
| 3. Penobscot River Basin | 14. Pawtuxet River Basin |
| 4. Maine Central Coastal | 15. Pawcatuck River Basin |
| 5. Kennebec River Basin | 16. Connecticut River Basin
and Connecticut Central Coastal |
| 6. Androscoggin River Basin | 17. Connecticut Western Coastal |
| 7. Presumpscot River and Casco Bay | 18. Housatonic River Basin |
| 8. Saco and Maine Southern Coastal | 19. Thames River Basin
and Connecticut Eastern Coastal |
| 9. New Hampshire Coastal | 20. Lake Champlain Basin |
| 10. Merrimack River Basin | 21. Lake Memphremagog - St. Francis
River Basin |
| 11. Massachusetts Coastal | 22. Long Island Sound |

FIGURE V- 2

FIGURE V-3
OCCURRENCE OF PROBLEM ISSUES BY
AGGREGATED SUBREGION AND PROBLEM AREAS —

NEW ENGLAND

Problem issues	101	1	2	3	4	5	6	102	7	8	9	10	103	11	12	13	14	15	104	17	18	19	*	105	16	106	20	21
Water Quantity																												
Fresh Surface	X									(X)	X	X	O	X	(X)	(X)	X	(X)	O	X	(X)		O	X				
Ground			X							(X)	X	(X)		(X)	(X)	(X)	(X)	(X)		X	X	X	X	X	X	X		
Marine & Estuarine																			O				O					
Surface/Depth																												
Water Quality																												
Fresh Surface	O	X	X	X	X	X	X	O	X	X	X	X	O	X	X	X	X	X	O	X	X	X	X	O	X	X	X	
Ground		X	X	X	X	X			X	X	X	O		X	X	X	X	X		X	X	X	X		X	X	X	
Marine & Estuarine	O		X		X				X	X	X	X		X	X				O	X	X	X	X		X			
Surface/Depth																												
Related Lands																												
Flooding	X	X	X	X	X	X	X		X	X	X	X	O	X	X	X	X	X	O	X	X	X	O	X	X	X		
Drainage																												
Erosion/Sediment	O	X			X	X	X		X	X	X	X	O	X	X	X	X	X		X	X	X		X	X	O	X	
Dredge & Fill. Subsidence			X	X	X	X	X	O	X	X		X	O	X	X		X		O	X	X	X	O	X	X			
Water Related Use Conflicts	O	X	X	X	X	X	X	O	X	X	X	X	O	X	X	X	X	X	O	X	X	X	X	O	X	O	X	X
Other																												

O Problem issues identified by Federal Agency Representatives

X Problem issues identified by State-Regional Representatives, 1975 - 1985 time frame

(X) Problem issues identified by State-Regional Representatives, 1985 - 2000 time frame

* Problem Area #22, Long Island Sound, consists of the Sound itself and considers coastal activities on Long Island which impact the Sound. Long Island is considered more completely in the Mid-Atlantic Region's ASR 202.

MID-ATLANTIC REGION

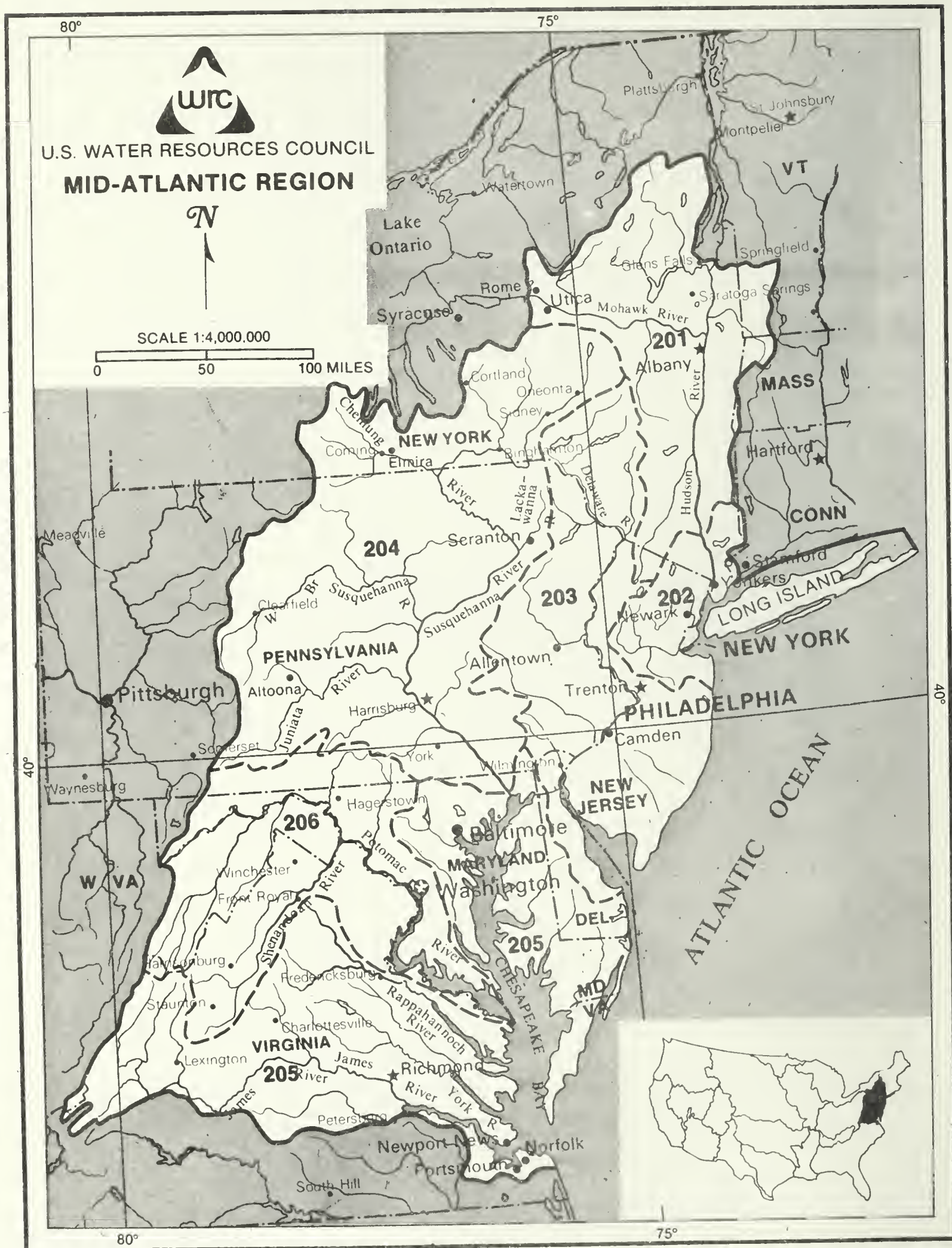


FIGURE V- 4

THE MID-ATLANTIC REGIONHighlights

- The Mid-Atlantic Region covers an area of about 103,375 square miles. Rivers in the northern half of the Region flow generally southward to the ocean; the southern rivers flow in an easterly direction. The Hudson and the Delaware Rivers flow to the Atlantic Ocean directly; the Susquehanna, Potomac, Rappahannock, York, and James Rivers empty into the Chesapeake Bay. The harbors and waterways of the Region are an integral part of the Nation's transportation system.
- The natural supply of water exceeds both present and anticipated demands but lacks desirable aspects of distribution and quality. Water supply shortages are becoming severe in certain areas throughout the Region, especially in headwater sub-basins, bays, estuaries, and lower tidal reaches of rivers. These supply problems will worsen as the population increases and as saline intrusion limits ground water withdrawals.
- The greatest amounts of water now withdrawn from streams and ground water are for manufacturing and steam-electric plants.
- The most severe and widespread problems involve local water supply; salt water intrusion; flooding of urban and developed lands and encroachments on flood plains; erosion and effects of sedimentation on water courses,

reservoirs, navigation channels, and wetlands; disposal of excavated and dredged materials and sewage sludge; and conflicts in water use among urban, industrial, conservation, and recreation uses.

- Twenty-seven geographic problem areas are identified (see Figures V-5 and V-6).
- The Mid-Atlantic regional assessment indicates that the Federal government should act as a unifying force and should provide cost-sharing programs. No new Level B studies are recommended. Data collection and research should be expanded to include flow requirements and instream needs. Recommendations are made regarding the need to analyze existing institutional arrangements. (For more detail see the Mid-Atlantic Regional Report.)

Comparative Analysis

Table V-2 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows and water use in the Mid-Atlantic region.

The differences in data are relevant to future planning in so far as they affect estimates of water supplies, withdrawals, consumption, and instream uses. The NF makes no projections regarding current downstream water rights, and the SRF assumes no changes in these matters.

Differences in NF and SRF withdrawal projections result from the different population estimates adopted by the States of New York, New Jersey, Virginia and Pennsylvania and from varying rates of per capita needs. Differences also exist regarding estimates of water needs of various manufacturing industries and for steam-electric generation. The larger SRF projections for irrigation withdrawals stem from projections by the State of Pennsylvania for its portions of ASRs 203, 204, and 206.

The probability of NF or SRF projections materializing depends on resolution of National policy and the resulting impacts of the economy, technological development, and public desires in the areas of energy development, implementation of environmental programs, and related matters. During the projected period, all views of the future need to be considered and adapted as policy is resolved and as decisions and future plans are made concerning water and related problems. The gross amount of water available on a regionwide level is much greater than either the NF or the SRF projections of withdrawal would require. In some cases, decisions on use will be made locally; e.g., in the category of irrigation. In other cases, such as needs of energy production, decisions on use will depend on national and international events, on production and use of fossil and nuclear fuels, and on alternative and still experimental means of fuel and energy production which presented problems of uncertainty in the early projections for the Assessment.

Table V-2

THE MID-ATLANTIC REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	39,612	38,933	43,873	42,265	49,939	46,709
Total Employment	17,097	17,108	19,730	19,730	23,307	23,306
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s)	79,160	78,984	78,494	NE	77,424	NE
Freshwater Withdrawals	18,297	18,909	15,854	17,032	13,869	16,122
Agriculture	333	529	435	779	552	1,025
Steam-Electric	7,463	7,872	7,130	7,734	4,657	5,947
Manufacturing	5,416	5,918	2,525	3,245	1,942	2,869
Domestic ^{1/}	3,954	4,155	4,467	4,740	5,168	5,598
Commercial	650	NA	726	NA	826	NA
Minerals	459	421	548	516	700	663
Public Lands	4	14	4	18	7	20
Fish Hatcheries	21	NE	21	NE	21	NE
Other	0	0	0	0	0	0
Freshwater Consumption	1,839	1,994	2,471	2,791	3,542	4,164
Agriculture	264	439	338	658	425	864
Steam-Electric	103	78	224	162	644	489
Manufacturing	606	678	935	1,073	1,358	1,773
Domestic ^{1/}	705	742	790	826	896	947
Commercial	91	NA	101	NA	114	NA
Minerals	70	52	82	65	102	82
Public Lands	3	5	3	7	6	9
Fish Hatcheries	0	NE	0	NE	0	NE
Other	0	0	0	0	0	0
Ground Water Withdrawals	2,661	2,811	NE	2,891	NE	3,011
Reservoir Evaporation	0	0	0	0	0	0
Instream Approximation						
Fish and Wildlife	68,840	68,840	68,840	68,840	68,840	68,840

^{1/} SRF domestic water use includes commercial and institutional requirements.

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



MID-ATLANTIC REGION

PROBLEM AREAS

1. Mohawk River above Little Falls, N.Y.
2. Hudson River above Albany, N.Y.
3. Hudson River Basin - Remainder
4. Nassau & Suffolk Cos., N.Y.
5. New York City & Westchester Co.
6. Passaic & Raritan Rivers, and Northern New Jersey Streams
7. Atlantic Ocean Drainage, Monmouth Co., N.J.
8. Delaware River above Montague, N.J.
9. Delaware River above Trenton, N.J.
10. Schuylkill River above Pottstown, Pa.
11. Lower Schuylkill River and Delaware Estuary
12. Atlantic Ocean Drainage, Remainder of New Jersey
13. Susquehanna River above Towanda, Pa.
14. West Branch, Susquehanna River, above Williamsport, Pa.
15. Juniata River above Newport, Pa.
16. Susquehanna River above Harrisburg, Pa.
17. Susquehanna River Basin - Remainder
18. Potomac River above Hancock, Md.
19. Shenandoah River above Millville, W.Va.
20. Potomac River Basin - Remainder
21. Patuxent River & Western Shore of Chesapeake Bay
22. Delmarva Peninsula & Eastern Shore of Chesapeake Bay
23. Rappahannock River Basin, Va.
24. York River Basin, Va.
25. James River above Scottsville, Va.
26. James River above Hopewell, Va.
27. James River Basin - Remainder

FIGURE V- 5

FIGURE V-6
OCCURRENCE OF PROBLEM ISSUES BY
AGGREGATED SUBREGION AND PROBLEM AREAS —

MID-ATLANTIC

Problem Issues	201	1	2	3	202	4	5	6	7	203	8	9	10	11	12	204	13	14	15	16	17	205	18	19	20	205	21	22	23	24	25	26	27
Water Quantity																																	
Fresh Surface	O	X	X	X	O	X	X	X	X	O	X	X	X	X	X	O	X	X	X	X	X	X	O			X							X
Ground	O				O	X		X		O	X	X	X	X	X		X	X	X	X		O	X	X	X	O			X			X	
Marine & Estuarine						X			X						X	O						O											X
Surface/Depth																O						O											
Water Quality																																	
Fresh Surface	O	X	X	X	O	X	X	X		O	X	X	X	X	X	O	X	X	X	X	X	O	X	X	X	X	O	X	X	X	X	X	
Ground					O	X	X	X	X	O	X	X	X	X	X		X				X	O	X	X	X	O	X	X			X	X	
Marine & Estuarine				X	O	X	X	X	X	O				X	X	O						O				X	O	X	X	X		X	X
Surface/Depth					O					O												O					O	X					
Related Lands																																	
Flooding	X				O	X	X	X	X	O	X	X	X	X	X	O	X	X	X	X	X	O	X			X	X	X	X	X	X	X	X
Drainage								X		O				X		O			X								O	X					
Erosion/Sediment	O			X	O	X	X		X	O	X				X	O	O	X	X	X	X	O		X	X	O	X	X			X	X	X
Dredge & Fill, Subsidence	O			X	O		X		X	O		X		X	X	O				X		O				O	X	X	X	X	X	X	X
Water Related Use Conflicts	O		X	X	O	X	X	X	X	O	X	X	X	X	X	O	X	X				O	X	X		X	X	X	X	X	X	X	X
Other	O		X	X	O					O		X										O				X	X	X					

O Problem Issues identified by Federal Agency Representatives

X Problem Issues identified by State-Regional Representatives

SOUTH ATLANTIC-GULF REGION



FIGURE V- 7

THE SOUTH ATLANTIC-GULF REGIONHighlights

- The South Atlantic-Gulf Region encompasses a total area of about 271,384 square miles. The Region contains 24 major river basins and many minor coastal river systems.
- The South Atlantic-Gulf Region has ample surface and ground water to provide for an expanding economy. There is an abundance of generally good quality ground water that can be developed in coastal plain areas. Water resources, however, are not always well-located within the Region with respect to needs, and local water shortages already occur in highly developed upstream areas.
- Steam-electric plants currently make the largest water withdrawals; there also are large water demands by the paper and pulp industry.
- Major problems with water and related land resources occur as the result of growth and related water demands in areas where water is limited. Stream headwaters and industrialized areas are particularly affected. In other areas, overpumping of ground water has led to salt water intrusion, another threat to usable water supply. In addition to water quantity limitations there are problems of excessive pollutants reaching the streams and coastal waters, and, in some areas, threatening ground water resources. Flood plain management and flood control structures are needed

in many areas of the Region. Protection of the beach areas and associated waters from erosion and water quality degradation is a major concern. Conflicts over the dredging and filling of wetlands, among other water and related land use issues, are a major concern within the Region. Numerous management problems occur along interstate streams regarding inter-basin and interstate transfers of water, and the Region contains many environmentally sensitive areas which deserve consideration.

- Fifteen geographic problem areas are identified (see Figures V-8 and V-9).
- In the South Atlantic-Gulf Region, the Federal government should assist in the resolution of problems having regional or national significance by supplying technical and financial support for programs such as construction of navigation systems, USDA Type IV Cooperative Studies, and data and research supplementation. Five geographic areas are listed as potential Level B study areas; additional planning studies are recommended for ten areas. An expansion of data collection and research is needed in twenty-one separate subject areas including streamflows, ground water aquifers, and water withdrawals and consumptive use. Outlined in the South Atlantic-Gulf Regional Report are fourteen institutional problems and the levels of government responsible for their resolution. (For more detail see the South Atlantic-Gulf Regional Report).

Comparative Analysis

Table V-3 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows and

water needs in the South Atlantic-Gulf Region. The totals for flows reflect total outflows from the nine ASRs of the South Atlantic-Gulf Water Resources Region.

The difference between SRF and NF data reflect discrepancies in assumptions, goals, and objectives at the regional and state level versus those at the national level. There is an assumption at the regional level that water withdrawals will tend to increase at a fairly high rate because of an abundance of water due to proper planning and management. NF data, on the contrary, assume a large reuse of water by 2000. Differences in manufacturing water use estimates reflect the SRF assumption that no major changes will take place in the reuse of water. NF data show manufacturing plants going to a practice of large reuse of water by 2000, thus reducing the total manufacturing withdrawals in the future. Some of the SRF manufacturing water use data from central systems could not be separated for tabular analysis. SRF data indicate a significant expansion of central public water systems to serve outlying areas, and they show a larger percentage being served by these systems in the future than the NF data show.

Table V-3

THE SOUTH ATLANTIC-GULF REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	25,423	26,164	29,334	30,736	34,680	36,761
Total Employment	10,345	10,518	12,282	12,682	14,727	15,542
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s)	228,010	228,034	225,762	NE	222,483	NE
Freshwater Withdrawals	24,512	26,461	25,452	29,256	28,338	34,777
Agriculture	3,598	5,262	4,174	6,123	4,711	6,955
Steam-Electric	12,768	13,262	12,912	12,930	13,952	13,937
Manufacturing	4,105	3,824	3,371	5,061	3,316	7,194
Domestic <u>1/</u>	2,288	3,016	2,801	3,701	3,486	4,714
Commercial	553	NA	632	NA	769	NA
Minerals	1,178	1,069	1,538	1,409	2,077	1,939
Public Lands <u>2/</u>	5	28	6	32	10	38
Fish Hatcheries	18	NA	18	NA	18	NA
Other	0	NE	0	NE	0	NE
Freshwater Consumption	4,867	6,062	6,777	7,760	10,054	10,272
Agriculture	2,886	4,210	3,350	4,904	3,799	5,586
Steam-Electric	153	156	722	721	1,857	1,856
Manufacturing	612	735	1,206	972	2,533	1,381
Domestic <u>1/</u>	880	786	1,079	934	1,345	1,139
Commercial	118	NA	138	NA	161	NA
Minerals	214	165	274	215	349	291
Public Lands <u>2/</u>	5	10	6	14	10	19
Fish Hatcheries	0	NA	0	NA	0	NA
Other	0	NE	0	NE	0	NE
Ground Water Withdrawals	5,449	7,039	NE	8,711	NE	10,688
Reservoir Evaporation	0	0	0	0	0	0
Instream Approximation <u>3/</u>						
Fish and Wildlife	188,655	557	188,655	648	188,655	648

1/ SRF domestic water use includes commercial and institutional requirements.

2/ SRF public lands water use includes fish hatcheries requirements.

3/ SRF lists legal requirements only; data was developed by specific river basins.

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



SOUTH ATLANTIC-GULF REGION

PROBLEM AREAS

- | | |
|--|-------------------------------------|
| 1. Cape Fear - North Central North Carolina | 8. Apalachicola-Chattahoochee-Flint |
| 2. Chowan-Lower Roanoke-Pasquotank | 9. Black Warrior-Cahaba |
| 3. Central North Carolina Coast | 10. Coosa in Georgia |
| 4. Catawba-Broad-Saluda | 11. Tombigbee |
| 5. Southeast South Carolina Coast | 12. Mobile-Lower Tombigbee |
| 6. Southeast South Carolina Coast, Georgia Coastal Plain, and Northern Florida | 13. Upper Pearl |
| 7. Florida Coast | 14. Mississippi Coast |
| | 15. Pascagoula |

FIGURE V- 8

FIGURE V-9
OCCURRENCE OF PROBLEM ISSUES BY
AGGREGATED SUBREGION AND PROBLEM AREAS*—

SOUTH ATLANTIC-GULF

Problem Issues	301	1	2	3	302	4	5	303	6	304	6	7	305	7	306	7	307	7	9	10	308	9	11	12	309	13	14	15
Water Quantity																												
Fresh Surface	0	X	X					0	0	0			0		0		X	0	X			X		X			X	
Ground			X	X					X		X												X					
Marine & Estuarine																												
Surface/Depth																		X										
Water Quality																												
Fresh Surface	0	X			0	X			0	0			0							X	0				0	X		
Ground	0	X				X		0	X	0	X		0									X	X				X	
Marine & Estuarine		X	X	X			X	0																		X		
Surface/Depth																												
Related Lands																												
Flooding		X	X	X														0										
Drainage	0	X						0					0											0				
Erosion/Sediment		X				X			0		X			X	0	X	0	X	0	X			X					
Dredge & Fill, Subsidence																												
Water Related Use Conflicts		X	X	X		X												X					X				X	
Other																												

O Problem Issues Identified by Federal Agency Representatives * The following problem areas do not lie entirely within one ASR. They are listed on the matrix under the ASR which contains the major part of the study area. Areas 6, 7, and 9 are listed under more than one ASR because a major portion of the problem area encompasses at least 2 ASRs.

1. Mainly in ASR 301; some in ASR 302.
2. Mainly in ASR 308; some in ASRs 307 and 309.
3. Mainly in ASR 306; some in ASRs 303, 304, and 307.
4. Mainly in ASR 302; some in ASR 303.
5. Mainly in ASR 309; some in ASR 308.
6. Mainly in ASRs 303 and 304; some in ASR 306.
7. In ASRs 304, 305, 306, and 307.
8. Mainly in ASR 306; some in ASRs 303, 304, and 307.
9. In ASRs 307 and 308.
10. Mainly in ASR 307; some in ASR 306.
11. Mainly in ASR 308; some in ASR 309.
12. Mainly in ASR 308; some in ASRs 307 and 309.
13. Mainly in ASR 309; some in ASR 308.
14. Mainly in ASR 309; some in ASR 308.
15. Mainly in ASR 309; some in ASR 308.

GREAT LAKES REGION

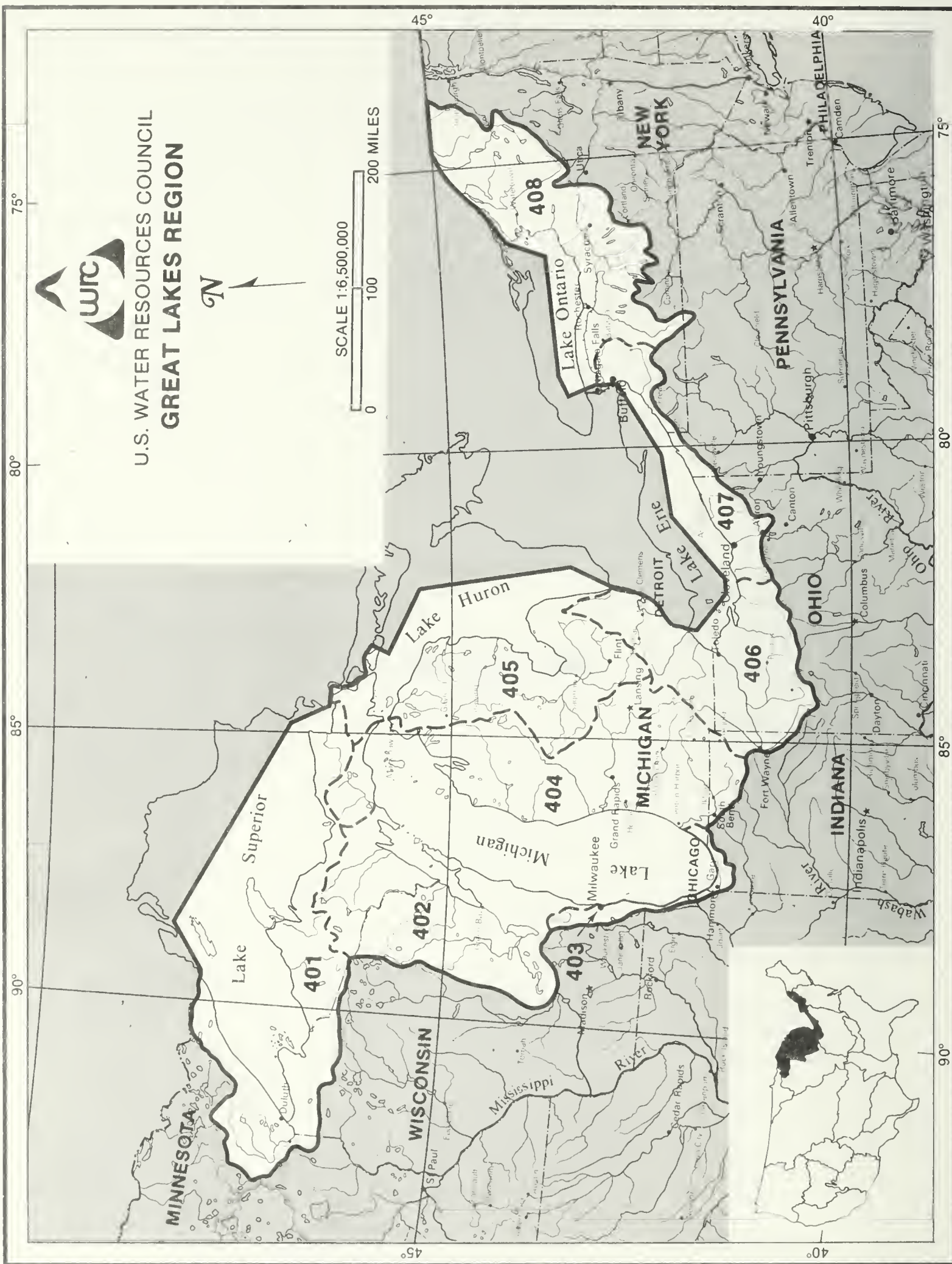


FIGURE V- 10

THE GREAT LAKES REGIONHighlights

- The Great Lakes Region, about 4 percent of the total land area of the 48 contiguous United States, contains about 134,216 square miles. Most of the water withdrawn from the Great Lakes hydrologic system comes directly from the Lakes, which together are the world's largest surface body of freshwater. An important navigation system is formed by the Lakes and their connecting waterways and channels.
- While the overall water supply in the Region is abundant, there are short-term problems with ground water depletion in localized areas, especially in Illinois, and with severe droughts in inland portions of Michigan, Minnesota, and Wisconsin.
- The largest amount of water withdrawn goes to cool steam-electric generating plants; manufacturing sectors consume the largest percentage of water.
- The major water resource difficulties include water quality, erosion and sedimentation, flooding and land use conflicts, and localized water supply and instream flow problems. Water quality concerns abound, especially in and near highly urbanized areas, and include toxic materials, eutrophication, and visual problems. The most critical pollution problem is found in Lake Erie. Flooding and erosion have resulted in significant economic

damages and have caused concern about flood plain and coastal land use. Erosion and sedimentation have lowered the potential for agricultural production, have impaired water quality, and have reduced the aesthetic and environmental attributes of streams and rivers throughout the Basin. Power production, navigation, and environmental disruptions occur periodically during times of low lake levels.

- Twenty-eight geographic problem areas are identified (see Figures V-11 and V-12).
- The Great Lakes Region recommends that the Federal government coordinate and fund resource programs to ensure a unified approach to water resource problems. Level B planning studies are prescribed for four areas of investigation. Numerous research and data needs are identified, and various institutional needs are discussed. (For detail see the Great Lakes Regional Report.)

Comparative Analysis

Table V-4 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows and water needs in the Great Lakes Region.

The Great Lakes Basin Commission adopted the position that the nationally generated National Future data describing socio-economic changes, volumetric data for withdrawal and consumptive use, and water supply information

would be acceptable as the State-Regional Future data for the Great Lakes Region. For those categories where NF data were not available, information was taken from the Great Lakes Basin Framework Study.

Table V-4

THE GREAT LAKES REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)*						
Total Population	30,391	30,392	32,855	32,855	36,351	36,350
Total Employment	12,796	12,796	14,446	14,445	16,583	17,223
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s)	72,710	72,710	71,976	NE	70,582	NE
Freshwater Withdrawals	42,809	42,809	32,660	32,660	25,621	25,621
Agriculture	230	230	296	296	369	369
Steam-Electric	24,362	24,362	22,689	22,689	16,061	16,061
Manufacturing	13,218	13,218	4,105	4,105	2,821	2,821
Domestic	3,267	3,267	3,614	3,614	4,077	4,077
Commercial	1,010	1,010	1,091	1,091	1,206	1,206
Minerals	696	696	831	831	1,044	1,044
Public Lands	6	6	13	13	17	17
Fish Hatcheries	22	22	26	26	28	28
Other	0	0	0	0	0	0
Freshwater Consumption	2,593	2,593	3,298	3,298	4,692	4,692
Agriculture	199	199	254	254	319	319
Steam-Electric	175	175	497	497	1,384	1,384
Manufacturing	1,472	1,472	1,719	1,719	2,056	2,056
Domestic	476	476	519	519	563	563
Commercial	113	113	123	123	140	140
Minerals	155	155	175	175	211	211
Public Lands	6	6	13	13	17	17
Fish Hatcheries	0	0	0	0	0	0
Other	0	0	0	0	0	0
Ground Water Withdrawals	1,215	1,215	NE	NE	NE	NE
Reservoir Evaporation	0	0	0	0	0	0
Instream Approximation						
Fish and Wildlife	63,951	63,951	63,951	63,951	63,951	63,951

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

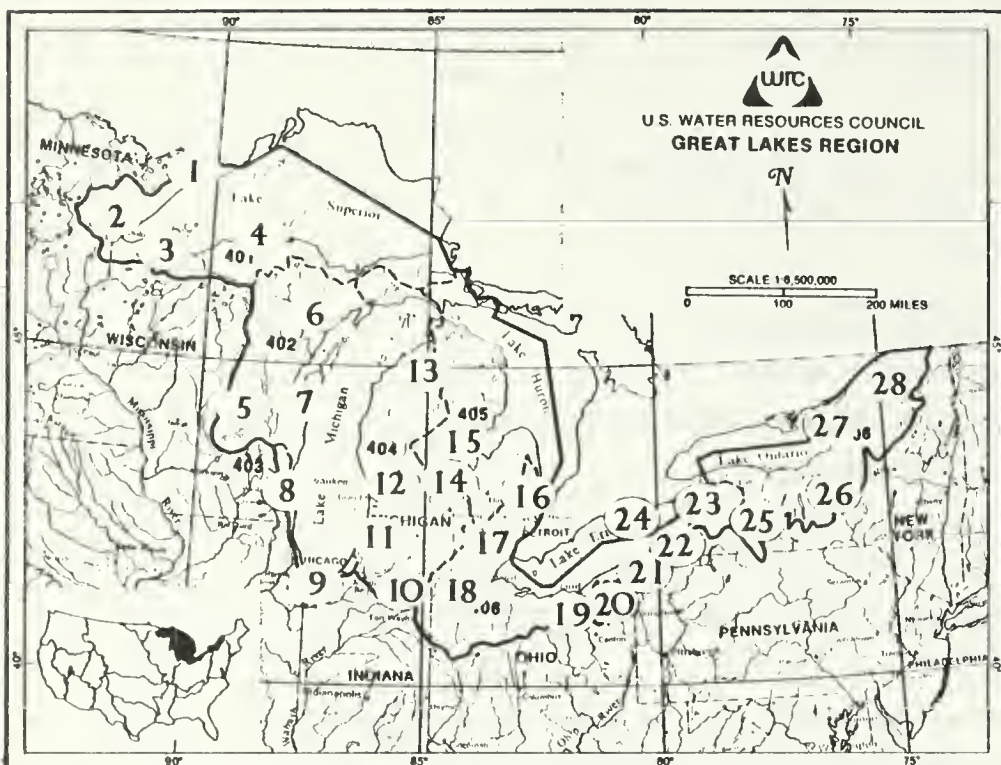
Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



GREAT LAKES REGION

PROBLEM AREAS

- | | |
|--|---|
| 1. Superior Slope Complex | 14. Saginaw River Basin |
| 2. St. Louis River Basin/Duluth Superior Area | 15. Saginaw Bay-Thumb Complex |
| 3. Apostle Islands, Bad River, Montreal River Complex | 16. Detroit Metropolitan Area |
| 4. Michigan's Upper Peninsula -- Lake Superior and Lake Huron Drainage | 17. Huron-Raisin Complex |
| 5. Fox-Wolf River Basin | 18. Maumee River Basin |
| 6. Northwest Shore of Lake Michigan | 19. Ohio Lake Plains |
| 7. Sheboygan-Green Bay Complex | 20. Cleveland-Akron Metro Area |
| 8. Southeast Wisconsin Complex | 21. Grand-Ashtabula-Conneaut River Basins |
| 9. Chicago-Indiana Complex | 22. Erie-Chautauqua Complex |
| 10. St. Joseph River Basin | 23. Erie-Niagara Region |
| 11. Kalamazoo-Black-Macatawa-Paw River Basins | 24. Lake Erie Basin |
| 12. Grand River Basin | 25. Genesee River Basin |
| 13. Northern Lower Peninsula | 26. Great Finger Lakes-Oswego River Basin |
| | 27. Lake Ontario Lake Plains |
| | 28. Black River-St. Lawrence Complex |

FIGURE V- II

FIGURE V-12
OCCURRENCE OF PROBLEM ISSUES BY
AGGREGATED SUBREGION AND PROBLEM AREAS —

GREAT LAKES

Problem Issues	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Water Quantity																												
Fresh Surface		X		X	X				X	X	X						X	X	X		X		X		X	X	X	
Ground				X	X	X					X	X					X	X	X		X		X					
Marine & Estuarine	X	X	X	X	X	X											X	X	X		X		X					
Surface/Depth																												
Water Quality	0			0	0		0		0										0									
Fresh Surface		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Ground				X	X	X	X	X	X		X	X	X	X	X	X	X	X	X		X		X					
Marine & Estuarine	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Surface/Depth																												
Related Lands																												
Flooding		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Drainage		X		X		X		X	X		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Erosion/Sediment	0	X	X	X	X	X	X	X	X	0	X	X	X	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Dredge & Fill, Subsidence		X	X	X	X	X	X	X	X		X	X	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Water Related Use Conflicts		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Other	0			X			0		X	0	X		X	X	X	X	X	X	0		X		X	X	X	X	X	X

0 Problem Issues Identified by Federal Agency Representatives

X Problem Issues Identified by State-Regional Representatives

OHIO REGION

1

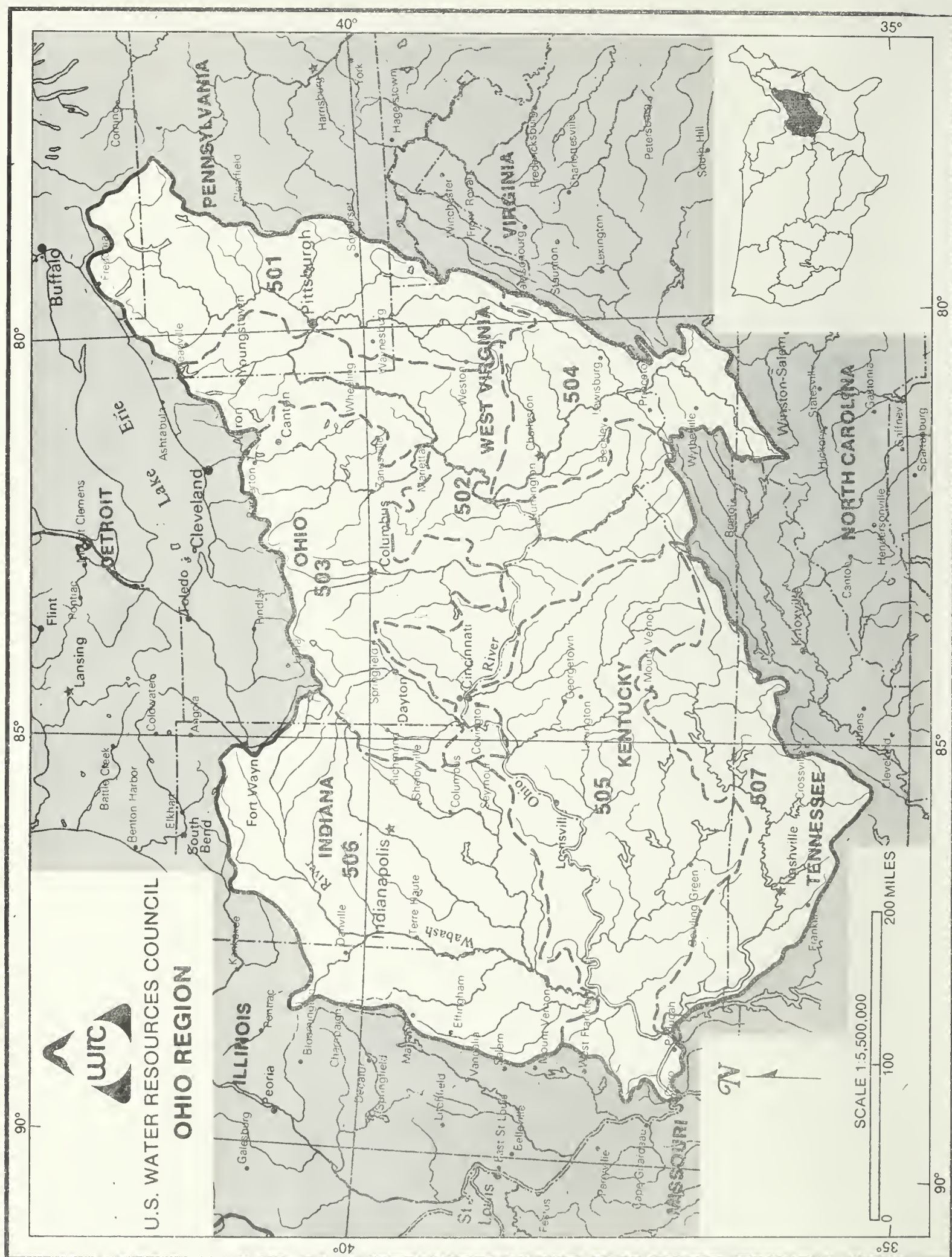


FIGURE V-13

THE OHIO REGIONHighlights

- The Ohio Region embraces a total area of about 160,107 square miles. The Ohio River is a key element of the Nation's inland waterways system.
- Overall, the Basin has an excellent potential for water supply that should enable its residents to overcome any supply problems. Ground water is a valuable regional resource, but in many areas it has not been developed to its water supply potential. The Ohio Region contains vast amounts of bituminous coal (about 70% of the national reserves) and relatively abundant water supplies which create a great potential for increased energy-related development within the Region. Water withdrawals for mining of fuels are projected to increase from less than one percent of the total withdrawals in 1975 to about 2 percent in 2000.
- Surface and ground water withdrawals have many uses, principally for steam-electric, followed by manufacturing.
- The major concern facing the Region is that of water quality, which is severe in metropolitan areas and downstream from these areas. Problems of acid mine drainage are the most significant, while industrial wastes, domestic sewage, and agricultural runoff are serious concerns as well. Erosion and sedimentation, flooding, land use conflicts, instream flow

inadequacies, and local supply problems require correction by improved management practices. Flood damage is experienced throughout the Basin particularly in urban areas, causing much industrial, residential, and transportation damages annually. Substantial agricultural flood damage also occurs in the Basin. Institutional and physical management decisions must be made to resolve conflicts among various interests such as navigation, recreation, and industries.

- Twenty-one geographic problem areas are identified (see Figures V-14 and V-15).
- A major role of the Federal government in water resources management within the Ohio Region is to help resolve problems of water pollution, especially those resulting from acid mine drainage, and to resolve problems of flooding through cost-sharing programs and coordination efforts. A regional plan has been developed already for the Basin, but specific areas should be investigated. Data and research needs are identified for: freshwater management in the Allegheny Basin, effects of hydrogen sulfide on fish, recreation, and inventory and classification of fisheries. (For detail see the Ohio Regional Report).

Comparative Analysis

Table V-5 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows

and water use in the Ohio Region. The Ohio Region has adopted the National Future as its State-Regional Future for these water data categories. Therefore, the NF and SRF values for withdrawals, consumption, and streamflow estimates are in agreement for the Ohio Region.

Table V-5
 THE OHIO REGION
 Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	21,158	21,157	22,722	22,722	24,791	24,791
Total Employment	8,313	8,313	9,429	9,429	10,838	10,838
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s)	178,000	178,000	176,941	NE	174,677	NE
Freshwater Withdrawals	34,927	34,947	27,835	27,835	16,923	16,923
Agriculture	160	160	195	195	230	230
Steam-Electric	21,022	21,022	21,008	21,008	10,574	10,574
Manufacturing	10,879	10,879	3,322	3,322	2,342	2,342
Domestic	1,842	1,842	2,068	2,068	2,343	2,343
Commercial	495	495	529	529	571	571
Minerals	493	493	662	662	808	808
Public Lands	5	5	8	8	12	12
Fish Hatcheries	36	36	45	45	46	46
Other	0	0	0	0	0	0
Freshwater Consumption	1,798	1,798	2,525	2,525	4,331	4,331
Agriculture	150	150	180	180	213	213
Steam-Electric	324	324	656	656	1,692	1,692
Manufacturing	816	816	1,091	1,091	1,758	1,758
Domestic	349	349	389	389	424	424
Commercial	62	62	67	67	74	74
Minerals	91	91	132	132	160	160
Public Lands	5	5	8	8	12	12
Fish Hatcheries	0	0	0	0	0	0
Other	0	0	0	0	0	0
Ground Water Withdrawals	1,843	1,843	NE	NE	NE	NE
Reservoir Evaporation	0	0	0	0	0	0
Instream Approximation						
Fish and Wildlife	160,520	160,520	160,520	160,520	160,520	160,520

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

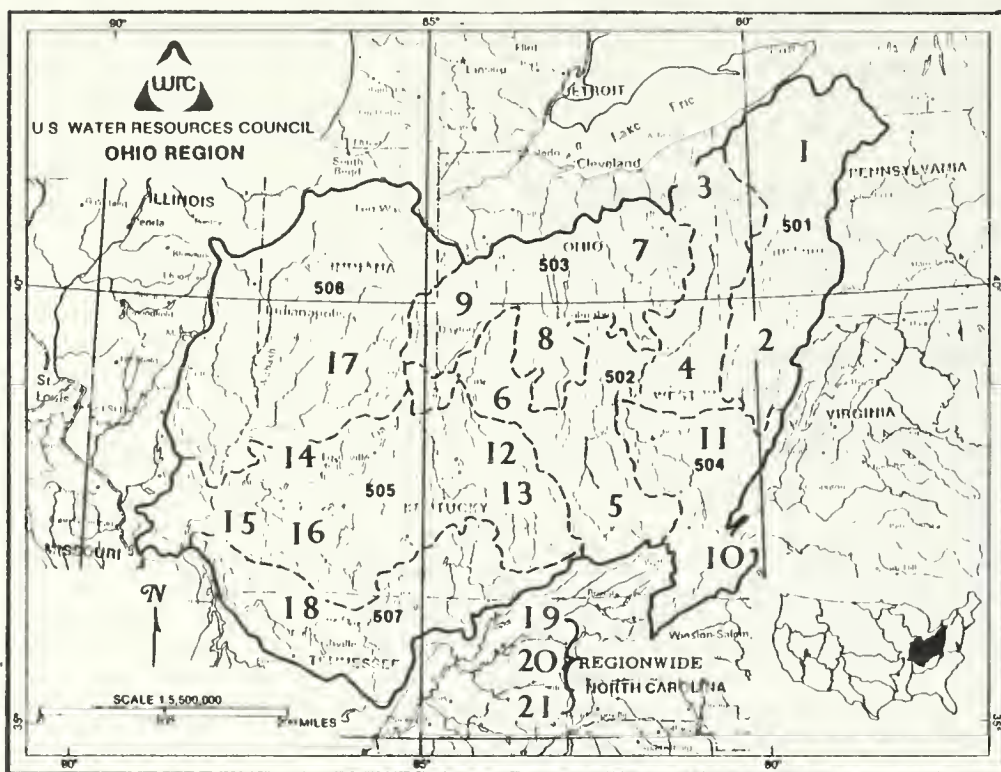
Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



OHIO REGION

PROBLEM AREAS

- | | |
|--------------------------------------|--------------------------------------|
| 1. Allegheny River Basin | 12. Licking River Basin |
| 2. Monongahela River Basin | 13. Kentucky River Basin |
| 3. Mahoning River Basin | 14. Lower Ohio River Main Stem |
| 4. Upper Ohio River Main Stem | 15. Tradewater River Basin |
| 5. Big Sandy-Guyandotte River Basins | 16. Green River Basin |
| 6. Middle Ohio River Main Stem | 17. Wabash River Basin |
| 7. Muskingum River Basin | 18. Cumberland River Basin |
| 8. Scioto River Basin | 19. Mine Drainage - Ohio River Basin |
| 9. Great Miami River Basin | 20. Non-Point Source Pollution |
| 10. New River Basin | 21. Energy |
| 11. Kanawha River Main Stem | |

FIGURE V-14

FIGURE V-15
OCCURRENCE OF PROBLEM ISSUES BY
AGGREGATED SUBREGION AND PROBLEM AREAS —
OHIO

Problem issues	501	1	2	502	3	4	5	6	503	7	8	9	504	10	11	505	12	13	14	15	16	506	17	507	18	A11	19	20	21
Water Quantity																													
Fresh Surface		X	X		X					X	X			X	X		X	X	X	X			X		X	X		X	
Ground								X			X														X	X			
Marine & Estuarine																													
Surface/Depth		X								X	X	X					X	X	X				X					X	
Water Quality	O			O					O				O									O			O				
Fresh Surface		X	X		X	X	X	X		X	X	X		X	X		X	X	X	X	X		X		X	X		X	
Ground						X				X		X									X				X	X			
Marine & Estuarine																													
Surface/Depth																													
Related Lands																													
Flooding		X	X	O	X	X		X	O	X	X	X	O	X	X		X	X	X	X	X		X		X				
Drainage					X					X	X	X		X	X				X	X	X		X						
Erosion/Sediment	O			O		X	X	X	O				O	X	X		O		X	X	X	O	X	O		O	X	X	
Dredge & Fill, Subsidence																		X											
Water Related Use Conflicts		X	X																	X			X						
Other	O			O					O				O									O		O					

O Problem Issues Identified by Federal Agency Representatives
X Problem Issues Identified by State-Regional Representatives

TENNESSEE REGION

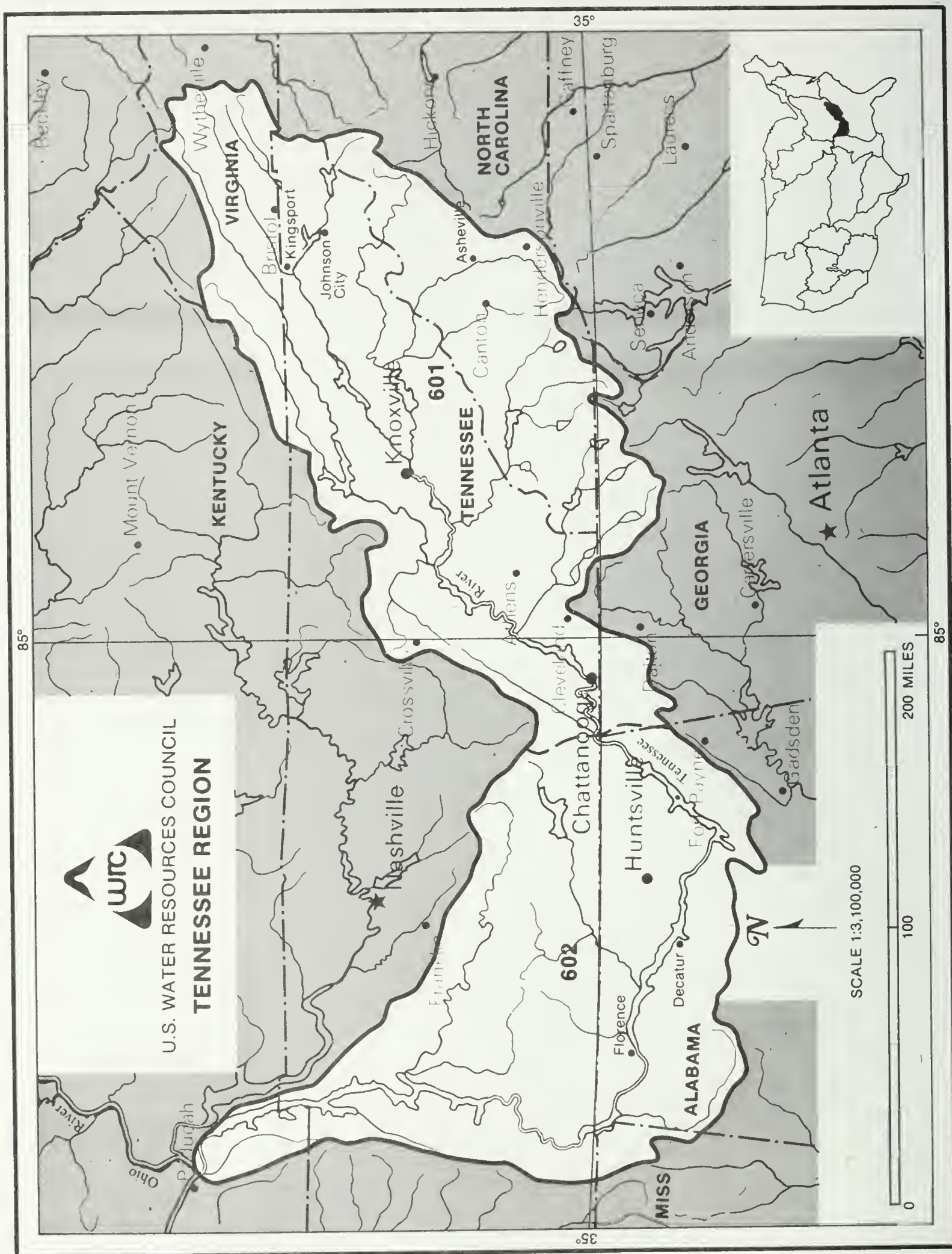


FIGURE V- I 6

THE TENNESSEE REGIONHighlights

- The Tennessee Region covers an area of about 42,654 square miles. Seven large and numerous small rivers feed the Tennessee River as it makes its U-shaped course through the Region. Parts of seven states are drained, more than half of Tennessee and smaller portions of Alabama, Georgia, Kentucky, Mississippi, North Carolina, and Virginia.
- The Tennessee Region has ample land and water resources to provide for an expanding economy with a quality environment, and the overall water supply situation is excellent. Problems with streamflows in the Region are due generally to conflicts in use rather than to quantity of streamflows.
- The major portion of water withdrawals is used by steam-electric plants.
- The most severe problems are those associated with water quality, flooding, erosion and sedimentation, land and water use conflicts, local water supply, and navigational lock capacity. Water and land problems are generally more severe in the upstream areas in the eastern part of the Region and near Chattanooga at the center of the Region. Water pollution is acute at the manufacturing centers and in upstream areas where paper and pulp plants are located. Flooding is a problem throughout the Region, but is most severe in the east where the rugged terrain limits the amount of developable land and encourages building in the flood plain. Water

supply shortages are very localized and generally are limited to areas near the basin rim. Occasional shortages occur farther downstream because of conflicts in water use among recreation, hydropower generation, and industrial water supply users.

- Eight geographic problem areas are identified (see Figures V-17 and V-18).
- Several Level B studies are proposed for various portions of the Tennessee Region. In addition, planning studies and programs are necessary to prevent increases in flood damages, to change selected stretches of rivers to wild and scenic status, and to reclaim lands degraded by mining activities. Endangered species, point sources of pollution, and navigation are currently under study, but may need further attention. Research is needed to determine the effects of reservoir releases on fish and aquatic life and to develop means of aquatic weed control. (For details see the Tennessee Regional Report.)

Comparative Analysis

Table V-6 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows and water use in the Tennessee Region.

Both views of the future need to be considered in making decisions and future plans concerning water-related problems. The amount of water required to meet the SRF projected manufacturing demands is much greater

than that required by the NF projections. The NF assumed future high rates of recirculation as a conservation measure, while the SRF assumed there would be little pressure to conserve because of the Region's abundance of water, except in some headwater areas where the recirculation rates are already very high. Differences in irrigation water are high, but irrigation uses an insignificant portion of the Region's water, and any effect on the Region's resource will be very localized.

Table V-6

THE TENNESSEE REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	3,565	3,565	4,034	4,034	4,615	4,615
Total Employment	1,359	1,359	1,617	1,617	1,943	1,943
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s)	40,800	40,800	40,469	NE	40,011	NE
Freshwater Withdrawals	7,412	7,282	7,129	8,842	6,012	8,865
Agriculture	41	31	50	39	58	44
Steam-Electric	4,799	4,799	5,738	5,738	4,581	4,581
Manufacturing	2,094	1,973	764	2,487	670	3,537
Domestic	263	263	319	319	383	383
Commercial	90	90	102	102	116	116
Minerals	110	110	140	140	186	186
Public Lands	1	1	2	2	3	3
Fish Hatcheries	15	15	15	15	15	15
Other	0	0	0	0	0	0
Freshwater Consumption	314	294	644	539	1,103	791
Agriculture	38	31	46	38	54	44
Steam-Electric	42	42	231	231	417	417
Manufacturing	148	135	266	166	514	210
Domestic	59	59	69	69	76	76
Commercial	11	11	12	12	14	14
Minerals	15	15	21	21	27	27
Public Lands	1	1	2	2	3	3
Fish Hatcheries	0	0	0	0	0	0
Other	0	0	0	0	0	0
Ground Water Withdrawals	271	271	NE	277	NE	277
Reservoir Evaporation	0	0	0	0	0	0
Instream Approximation						
Fish and Wildlife	38,480	38,480	38,480	38,480	38,480	38,480

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

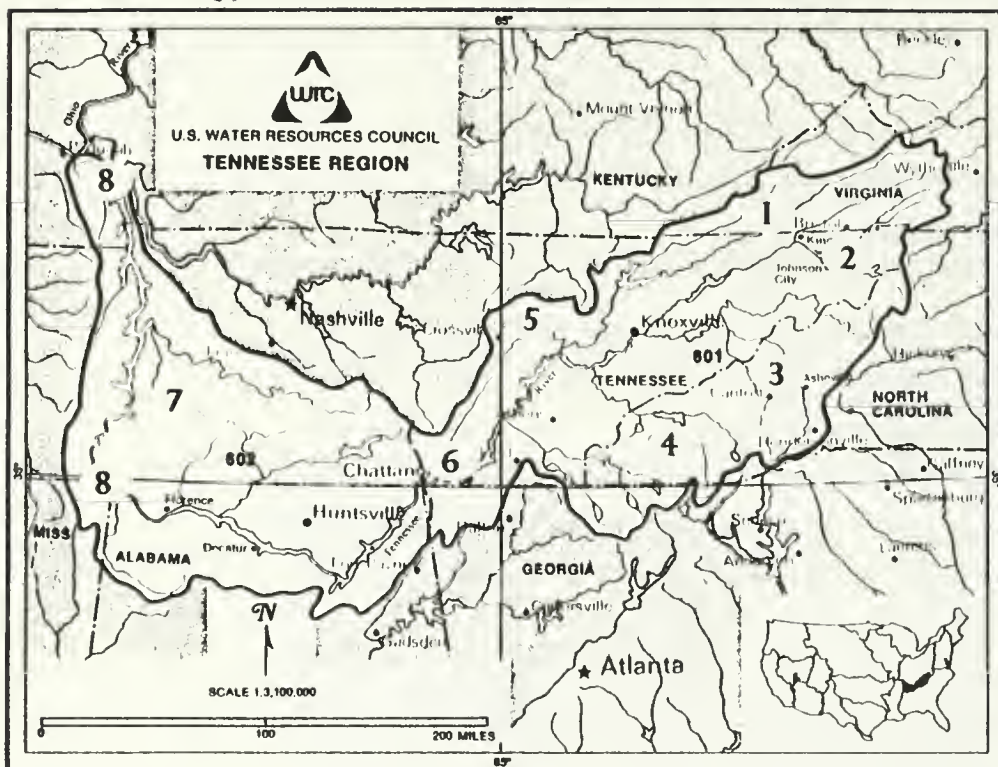
Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



TENNESSEE REGION

PROBLEM AREAS

1. Clinch-Powell
2. Holston
3. French Broad
4. Little Tennessee-Hiwassee
5. Emory
6. Chattanooga
7. Buffalo
8. Navigation

FIGURE V-17

TENNESSEE

Problem Issues	101	1	2	3	4	5	6	602	7	8
Water Quantity										
Fresh Surface	X	X			X	X			X	
Ground										
Marine & Estuarine										
Surface/Depth						X			X	
Water Quality										
Fresh Surface	O	X	X	X	X	X	O			
Ground										
Marine & Estuarine										
Surface/Depth										
Related Lands										
Flooding	O	X	X	X	X	X	O		X	
Drainage										
Erosion/Sediment	O	X		X	X	X	O		X	
Dredge & Fill. Subsidence						X				
Water Related Use Conflicts		X	X	X	X					
Other					X	X			X	

O Problem Issues Identified by Federal Agency Representatives

Problem Issues Identified by State-Regional Representatives

UPPER MISSISSIPPI REGION

FIGURE V-19

THE UPPER MISSISSIPPI REGIONHighlights

- The Upper Mississippi Region includes the drainage area of the Mississippi River above its confluence with the Ohio River and encompasses about 180,731 square miles. Many rivers flow through the Region in a general north-south direction, and the Mississippi River bisects the area. Tributaries of the Mississippi drain most of Minnesota, Wisconsin, Illinois, and Iowa; a significant portion of Missouri; and small areas in Indiana, Michigan, and South Dakota. The Upper Mississippi River is a key element in the Nation's inland waterway system. Large amounts of ground water are stored within much of the Region.
- The regional gross water supply situation is excellent, and land and water resources are ample to provide for an expanding economy with a quality environment.
- Water is withdrawn from the streams and ground for many uses; the largest amount is used as cooling water for steam-electric plants.
- The most severe concerns are those associated with water quality, erosion and sedimentation, flooding, land use conflicts, local water supply, instream flow inadequacies, drainage, and navigation and dredging. Water quality problems and erosion and sedimentation tend to be more severe in the downstream portions of the Region. Water quality is often a major

concern in metropolitan areas, while serious water supply shortages occur in some rural places. During drought periods, locally high withdrawal and consumptive use demands create supply and instream flow problems.

- Thirty-seven geographic problem areas are identified (see Figures V-20 and V-21).
- Conclusions and recommendations are made regarding water quality, water supply, fish and wildlife/recreation, preservation of environmental quality, flood damage reduction and watershed protection, and other multifaceted needs using three approaches: needs for planning studies; needs for modified and/or further research and data collection; and needs for changes in existing institutional arrangements, water policies, and water-oriented programs. In the Upper Mississippi Region, the role of the Federal government should emphasize coordination and funding of water resources efforts. (For more detail see the Upper Mississippi Regional Report).

Comparative Analysis

Table V-7 presents a comparison of the National Future (NF) and the State-Regional Future (SRF) with regard to estimates of streamflows and water needs in the Upper Mississippi Region.

NF and SRF estimates of total withdrawals show close similarity. Two internal discrepancies exist, however, in the agriculture and domestic

categories. The SRF projections for irrigation water requirements are consistently larger than those of the NF while SRF projections for domestic use are smaller than the corresponding NF figures. Excellent agreement between SRF and NF consumptive use data exists for 1975. The total estimates become more discrepant in future years. SRF irrigation and domestic use projections again vary quite markedly from the NF data.

Both views of the future need to be considered in making decisions and future plans concerning water-related problems. The amount of water required to meet the SRF projected irrigation needs is much greater than that required by the NF projections. Decisions relating to this irrigation development will be made locally and its impact on the water supplies will be local. On a regionwide basis, the amounts of water involved in irrigation in either case are only a small percentage of available water.

Table V-7

THE UPPER MISSISSIPPI REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	13,387	13,228	14,408	14,096	15,822	15,716
Total Employment	5,615	5,615	6,325	6,325	7,202	7,202
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s)	121,000	117,279	113,867	NE	111,231	NE
Freshwater Withdrawals	12,397	12,352	10,377	10,380	7,908	7,905
Agriculture	422	497	566	899	691	1,027
Steam-Electric	7,644	7,644	6,347	6,347	3,537	3,537
Manufacturing	2,029	2,283	882	974	727	795
Domestic	1,450	1,073	1,609	1,182	1,808	1,400
Commercial	515	515	552	552	603	603
Minerals	333	333	417	417	533	533
Public Lands	2	2	3	3	4	4
Fish Hatcheries	5	5	6	6	6	6
Other	0	0	0	0	0	0
Freshwater Consumption	1,144	1,153	1,600	1,821	2,687	2,908
Agriculture	383	441	513	779	627	888
Steam-Electric	129	129	352	352	1,079	1,079
Manufacturing	239	259	308	338	508	552
Domestic	282	213	302	224	324	237
Commercial	63	63	67	67	74	74
Minerals	46	46	58	58	74	74
Public Lands	2	2	3	3	4	4
Fish Hatcheries	0	0	0	0	0	0
Other	0	0	0	0	0	0
Ground Water Withdrawals	2,366	2,127	NE	1,698	NE	1,718
Reservoir Evaporation	37	2,468	37	2,468	37	2,468
Instream Approximation						
Fish and Wildlife	110,750	110,750	110,750	110,750	110,750	110,750

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

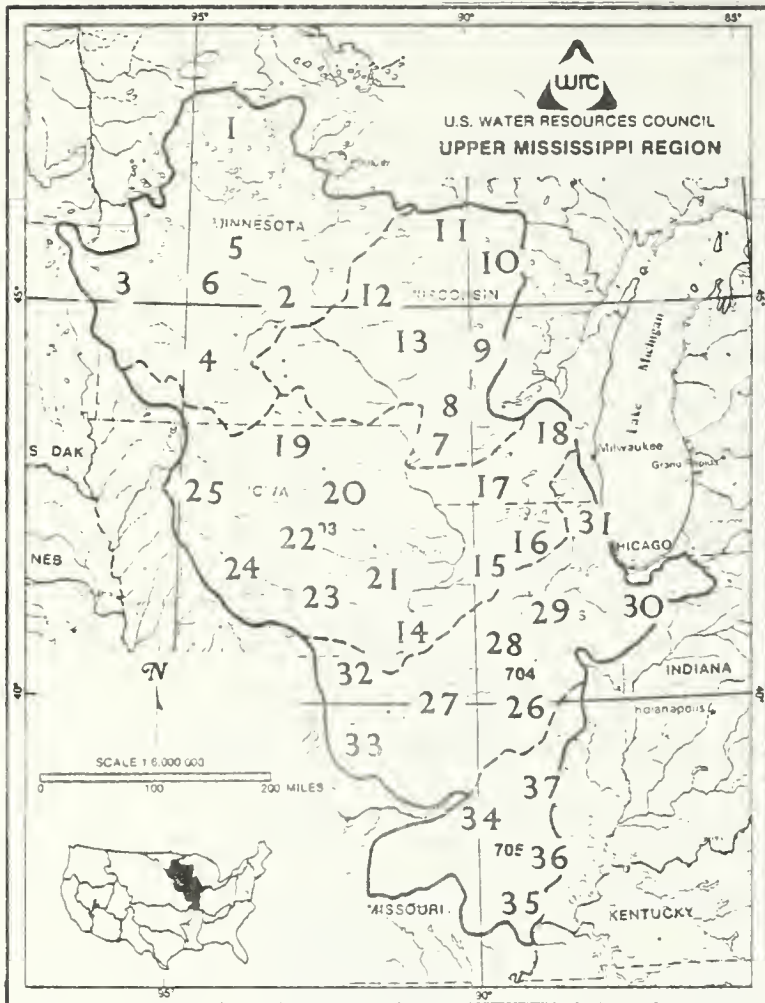
Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



UPPER MISSISSIPPI REGION

PROBLEM AREAS

- | | | |
|---|---|---|
| 1. Mississippi River Headwaters (Minnesota) | 13. Black, Buffalo, and Trempealeau River Basins (Wisconsin) | 27. Lower Illinois River and Tributaries (Illinois) |
| 2. Minneapolis - St. Paul S.M.S.A. (Minnesota) | 14. Middle Mississippi River Main Stem (Illinois, Iowa, and Missouri) | 28. Middle Illinois River and Tributaries (Illinois) |
| 3. Upper Minnesota River Basin (Minnesota and South Dakota) | 15. Lower Rock River Basin (Illinois) | 29. Upper Illinois River and Tributaries (Illinois) |
| 4. Lower Minnesota River Basin (Minnesota) | 16. Kishwaukee River Basin (Illinois) | 30. Kankakee River Basin (Illinois and Indiana) |
| 5. Clearwater River Basin (Minnesota) | 17. Pecatonica River Basin (Illinois and Wisconsin) | 31. Fox River Basin (Illinois and Wisconsin) |
| 6. Crow River Basin (Minnesota) | 18. Upper Rock River Basin (Illinois and Wisconsin) | 32. Fabius River Basin (Missouri) |
| 7. Upper Mississippi River Main Stem (Illinois, Iowa, Minnesota, and Wisconsin) | 19. Upper Cedar River Basin (Iowa and Minnesota) | 33. Salt River Basin (Missouri) |
| 8. Lower Wisconsin - LaCross River Basin (Wisconsin) | 20. Middle Cedar River Basin (Iowa) | 34. St. Louis S.M.S.A. (Illinois and Missouri) |
| 9. Central Wisconsin River Basin (Wisconsin) | 21. Lower Iowa - Cedar Rivers (Iowa) | 35. Lower Mississippi River Basin (Illinois and Missouri) |
| 10. Upper Wisconsin River Basin (Wisconsin) | 22. Middle Iowa River (Iowa) | 36. Big Muddy River and Tributaries (Illinois) |
| 11. Upper Chippewa River Basin (Wisconsin) | 23. Skunk River Basin (Iowa) | 37. Kaskaskia River Basin (Illinois) |
| 12. Lower Chippewa River Basin (Wisconsin) | 24. Middle Des Moines River (Iowa) | |
| | 25. Upper Des Moines River Basin (Iowa and Minnesota) | |
| | 26. Sangamon River Basin (Illinois) | |

FIGURE V- 20

FIGURE V- 21
OCCURRENCE OF PROBLEM ISSUES BY
AGGREGATED SUBREGION AND PROBLEM AREAS —

UPPER MISSISSIPPI

Problem Issues	701	1	2	3	4	5	6	702	7	8	9	10	11	12	13	703	14	15	16	17	18	19	20	21	22	23	24	25	704	26	27	28	29	30	31	32	33	705	34	35	36	37							
Water Quantity																																																	
Fresh Surface	●	X	X	X	X						X											X	X						X	●	X	X																	
Ground		X	X	X	X						X				X					X	X							X	●	X	X																		
Marine & Estuarine																																																	
Surface/Depth	●	X							X							●		X	X	X								X	X	●	X																		
Water Quality																																																	
Fresh Surface	●	X	X	X	X	X				X	X	X	X	X	X	●		X	X	X	XX	X	X	X	X	X	X	X	●	X	X	X																	
Ground		X	X	X					X	X	X	X			X					X				X	X	X	X	●	X	X	X	X																	
Marine & Estuarine																																																	
Surface/Depth																																																	
Related Lands																																																	
Flooding		X	X	X	X	X			X	X	X	X			X	●	X	X	X	X	X							X	●	X	X	X	X	X	X	X													
Drainage	●	X	X	X	X												X	X	X	X								X	●																				
Erosion/Sediment	●	X	X	X	X	X	X		X	X	X	X	X	X	X	●	X	X	X	X	X	X	X	X	X	X	X	X	●	X	X	X	X	X	X	X													
Dredge & Fill, Subsidence	●	X			X				X							●	X	X	X	X								●	●																				
Water Related Use Conflicts	●	X	X	X	X				X	X	X	X	X	X	X	●	X	X	X	X	X							X	●																				
Other																																																	

● Problem Issues Identified by Federal Agency Representatives
X Problem Issues Identified by State-Regional Representatives

LOWER MISSISSIPPI REGION

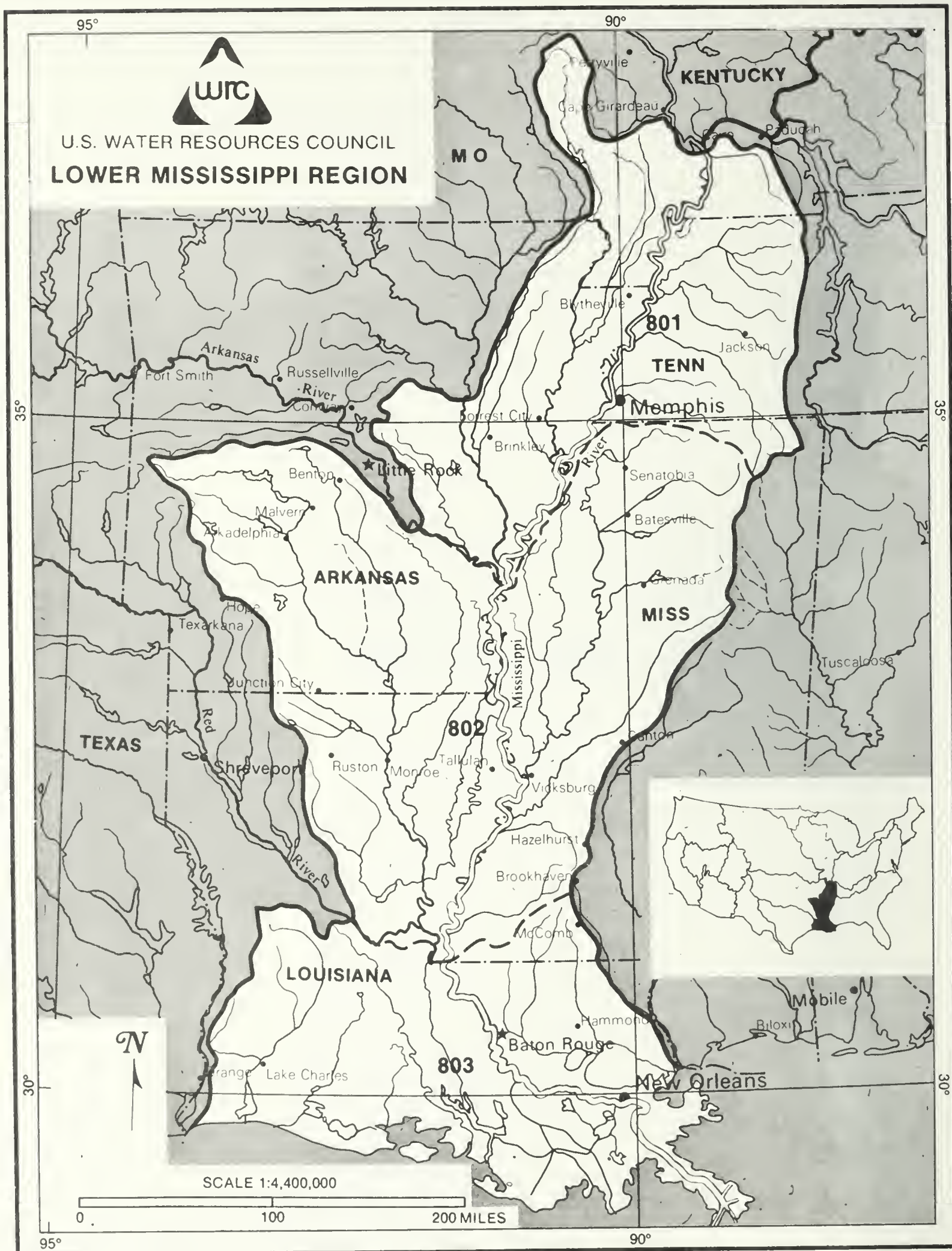


FIGURE V- 22

THE LOWER MISSISSIPPI REGIONHighlights

- The total area of the Lower Mississippi Region is about 105,177 square miles and includes portions of Missouri, Tennessee, Kentucky, Arkansas, Mississippi, and Louisiana. The Mississippi River and the Gulf Intra-coastal Waterway are nationally important navigation systems.
- In general, water supplies are adequate, and most water supply problems are related more to resource distribution than to availability. The Region has vast ground water reserves and benefits from the tremendous inflow from the Upper Mississippi and its tributaries. Localized shortages occur because of lack of access to drainage arteries and/or poor or insufficient ground water sources.
- The largest portion of water withdrawals is used for irrigation.
- The major needs and problems are concerned with water supplies for municipal, industrial, thermoelectric power generation, energy production, and irrigation uses and with developments for navigation, flood control, land treatment and management, fish and wildlife habitat, and water-oriented outdoor recreation. The maintenance and improvement of the existing navigation system in the Lower Mississippi Region is important on both regional and national levels. As far as the Region itself is concerned, however, flood control on the Mississippi River and tributaries

is the most severe and urgent problem. Approximately half of the entire area within the Lower Mississippi Region is subject to flooding. Most of the flood-prone lands are used for crop production and pasture. To meet the increased need for food in the future will require continued and accelerated planning for flood control and other resource development measures to ameliorate the major agricultural losses attributable to flooding.

- Forty-one geographic problem areas are identified (see Figures V-23 and V-24).
- It is recommended that the State of Mississippi statewide Level B Study be funded. Other studies needed are listed under Level C Type General Investigations and Special Studies. Data collection and research are needed to correct deficiencies in several important subject areas. Specific needs for institutional and policy changes are outlined, and the Federal role is described. Included in the Lower Mississippi Regional Report is a tabulation of pre-authorization, post-authorization, and special authority studies that must be finished so projects can be approved and constructed. (For more detail see the Lower Mississippi Regional Report.)

Comparative Analysis

Table V-8 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows and water use in the Lower Mississippi Region.

In a few functional use categories, such as steam-electric and agriculture, excellent agreement exists between NF and SRF withdrawal and consumptive use figures. The category showing the largest discrepancy is manufacturing. Since manufacturing is one of the largest water users in the Region, the discrepancy is quite significant. NF data for manufacturing water use were developed by the U.S. Bureau of Domestic Commerce (BDC) based on surveys made of major manufacturing concerns throughout the Nation. SRF data were taken from the Lower Mississippi Region Comprehensive Study, a recently completed interagency study which based its water use estimates on water use surveys, personal interviews, and published data. The methodology used by the NF and SRF to develop current manufacturing water use was very similar. On the other hand, the BDC assumed extremely high recirculation rates for future years which accounts for the large differences between SRF and NF manufacturing use in 1985 and 2000.

Other categories of water use in which significant discrepancies exist include Minerals, Domestic, and Other Functional Uses. Differences in "Minerals" and "Domestic" water use occur generally because of differences in data sources and methodology. As was the case with "Manufacturing" water use, it was not possible to resolve these discrepancies. In the category of "Other Functional Uses", the SRF data include a rather large water usage for fish and wildlife and commercial fishing. There is a significant documented use of water in these categories which the NF data do not recognize.

Table V-8

THE LOWER MISSISSIPPI REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	6,417	6,536	6,767	7,094	7,142	8,156
Total Employment	2,285	2,330	2,553	2,572	2,863	3,043
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s)	433,000	433,000	417,462	NE	411,307	NE
Freshwater Withdrawals	14,562	19,330	17,453	28,530	24,839	44,387
Agriculture	4,624	4,889	4,613	5,011	4,507	5,316
Steam-Electric	4,175	4,175	9,313	9,313	16,687	16,687
Manufacturing	4,159	5,498	1,634	8,888	1,363	16,102
Domestic <u>1/</u>	655	800	721	900	790	1,185
Commercial	150	NA	159	NA	170	NA
Minerals <u>2/</u>	799	189	1,010	249	1,318	332
Public Lands	1	NE	3	NE	4	NE
Fish Hatcheries	<1	NE	<1	NE	<1	NE
Other <u>3/</u>	0	3,779	0	4,169	0	4,765
Freshwater Consumption	4,025	8,304	4,553	9,476	5,510	11,820
Agriculture	3,109	3,531	3,258	3,632	3,335	3,877
Steam-Electric	54	54	118	118	291	291
Manufacturing	314	997	551	1,672	1,067	3,047
Domestic <u>1/</u>	294	366	319	416	344	499
Commercial	49	NA	51	NA	54	NA
Minerals <u>2/</u>	206	48	253	56	416	131
Public Lands	1	NE	3	NE	4	NE
Fish Hatcheries	0	NE	0	NE	0	NE
Other <u>3/</u>	0	3,308	0	3,582	0	3,975
Ground Water Withdrawals	4,838	6,413	NE	7,616	NE	9,123
Reservoir Evaporation	0	0	0	0	0	0
Instream Approximation						
Fish and Wildlife	359,033	NE	359,033	NE	359,033	NE

1/ SRF domestic water use includes commercial and institutional requirements.

2/ A portion of SRF minerals water use includes saline water.

3/ SRF other water use includes fish and wildlife and commercial fishing requirements.

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

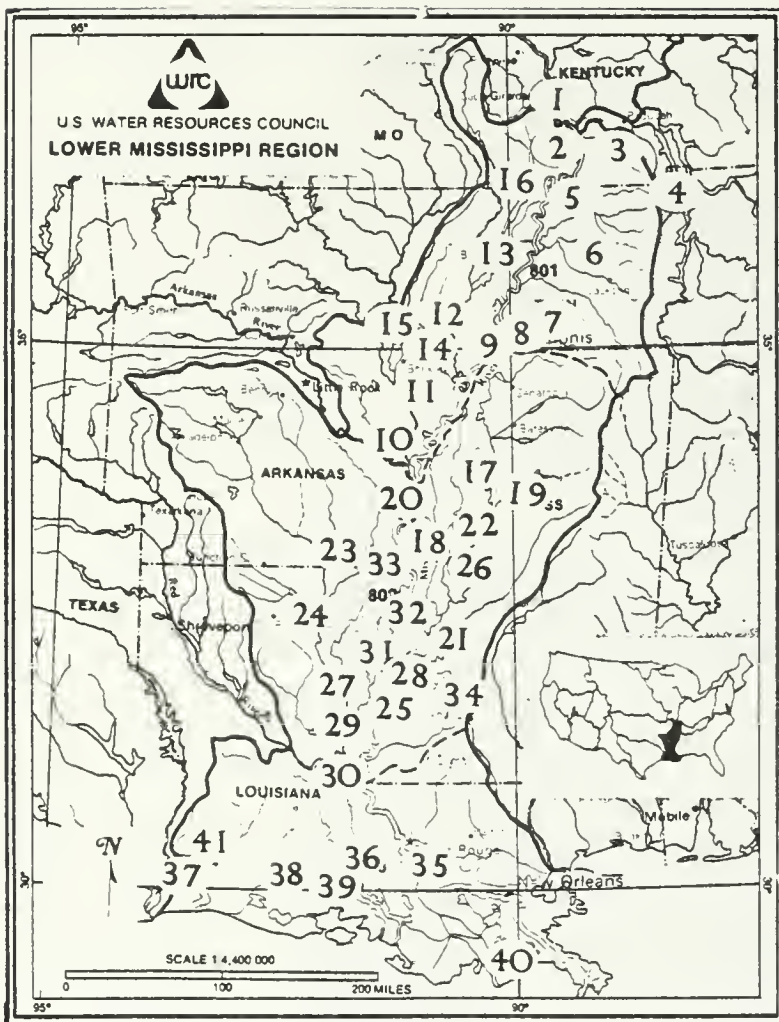
Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



LOWER MISSISSIPPI REGION

PROBLEM AREAS

- | | | |
|---|-----------------------------------|--|
| 1. Above St. John's Bayou | 15. Cache River Basin | 29. Loto Lake to Jonesville |
| 2. St. John's Bayou and New Madrid Floodway | 16. Little River Basin | 30. Below Red River |
| 3. Mayfield Creek Basin | 17. Upper Yazoo | 31. Franklin Parish, Louisiana |
| 4. Bayou du Chien | 18. Steele Bayou | 32. Tensas River |
| 5. Mud Lake | 19. Yazoo River | 33. Mississippi River (main stem) |
| 6. Obion and Forked Deer Rivers | 20. Greenville, Mississippi | 34. Homechitto River - Bayou Pierre |
| 7. Wolf-Losahatchie Basin | 21. Vicksburg, Mississippi | 35. New Orleans-Baton Rouge |
| 8. Nonconnah Creek | 22. Greenwood, Mississippi | 36. Atchafalaya Basin Floodway |
| 9. Horn Lake Creek | 23. Crossett, Arkansas | 37. Gulf Intracoastal Waterway |
| 10. Lower White River | 24. Monroe-West Monroe, Louisiana | 38. Mermentau River Basin |
| 11. Big Creek (Arkansas) | 25. Tensas-Cocodrie | 39. Bayou Teche-Vermillion River Basin |
| 12. St. Francis Basin | 26. Yazoo Blackwater | 40. Grand Isle and Vicinity |
| 13. Mississippi River Main Stem | 27. Bushley Bayou | 41. Lake Charles and Vicinity |
| 14. L'Anguille River | 28. Sicily Island | |

FIGURE V-23

FIGURE V-24
OCCURRENCE OF PROBLEM ISSUES BY
AGGREGATED SUBREGION AND PROBLEM AREAS —
LOWER MISSISSIPPI

Problem Issues	108	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	
Water Quality																																											
Fresh Surface		X				X	X	X	X	X		X			X					X						X						X						X		X	X		
Ground										X																															X		
Marine & Estuarine																																											
Surface/Depth						X	X	X	X	X	X	X	X						X	X	X	X				X							X						X				
Water Quality																																											
Fresh Surface			X	X			X	X											X	X	X	X				X							X						X				
Ground																																											
Marine & Estuarine																																											
Surface/Depth											X								X																								
Related Lands																			X																								
Flooding	O	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Drainage	O	X	X		X			X	X	X	X	X	X	X				O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						X	X		
Erosion/Sediment	O		X	X		X	X	X	X	X	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Dredge & Fill, Subsidence													X							X																							
Water Related Use Conflicts	X							X											X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Other	O	X																O																									

O Problem Issues Identified by Federal Agency Representatives

X Problem Issues Identified by State-Regional Representatives

SOURIS-RED-RAINY REGION

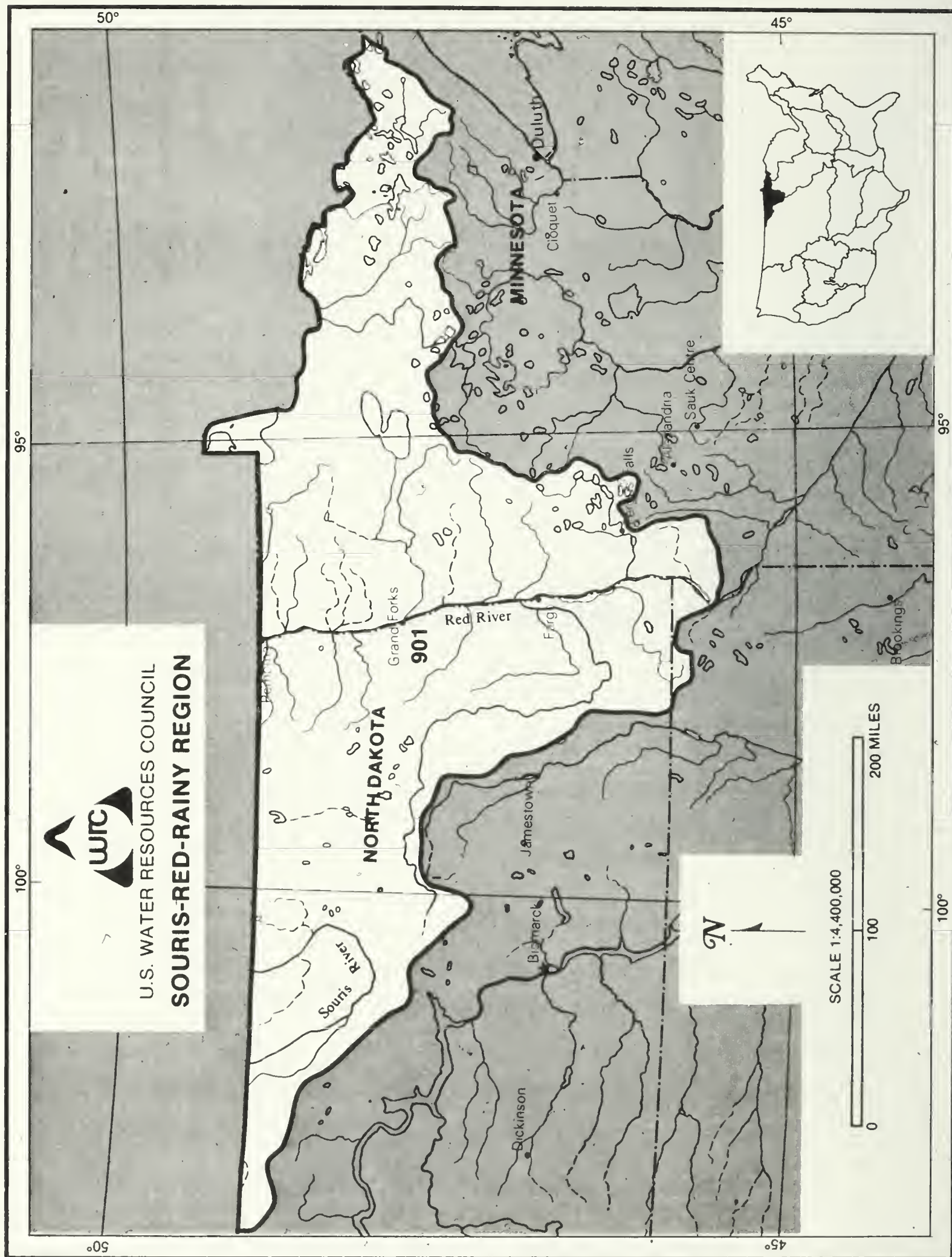


FIGURE V- 25

THE SOURIS-RED-RAINY REGIONHighlights

- The Souris-Red-Rainy Region encompasses about 54,738 square miles in the drainage areas of these three rivers. Flowing northward, the Souris-Red-Rainy Rivers eventually empty into Canada's Hudson Bay.
- In most of the Minnesota portion of the Region, water resources are quite abundant and are generally more than sufficient to meet needs. In the more western portions of the Region, however, water resources can be quite limited in drought periods.
- Manufacturing and irrigation account for the largest amounts of water withdrawals.
- The Souris-Red-Rainy Region contains an array of water and related land resources problems and issues. Some of these, such as flooding, drought, wetness, wind and water erosion, and loss of waterfowl habitat, are long-standing problems. Others, including a shortage of water-based recreational opportunities, pollution of streams and ground water, lake eutrophication, and inadequate municipal and industrial water supplies, have been recognized only recently as being serious. Conflicts occur among competing users of water and related land resources.
- Twenty-nine geographic problem areas are identified with 9 listed as areas of major urgency (see Figures V-26 and V-27).

- Conclusions and recommendations regarding the need for planning studies are presented in the Souris-Red-Rainy Regional Report along with an indication of the governmental level having primary responsibility to implement these projects. Data collection and research deficiencies in numerous areas should be corrected. Specific suggestions for institutional and policy changes are discussed. In the Souris-Red-Rainy Region, the Federal government should provide coordination and funding for water resources efforts. (For details see the Souris-Red-Rainy Regional Report.)

Comparative Analysis

Table V-9 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows and water use in the Souris-Red-Rainy Region.

NF and SRF total withdrawals and consumption are in close agreement for 1975 and 1985. In the year 2000, SRF total estimates are significantly larger than those of the NF because of larger SRF projections for irrigation water requirements.

The National Future and the State-Regional Future should both be considered in making decisions and future plans concerning water-related problems. Decisions related to irrigation development will be made locally and its impact on the water supplies will be local; over the Region as a whole, the amounts of water involved in irrigation in either case are only a small percentage of available water.

Table V-9

THE SOURIS-RED-RAINY REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	649	649	625	625	595	595
Total Employment	241	241	244	244	246	246
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s)	6,010	6,010	5,976	NE	6,314	NE
Freshwater Withdrawals	337	330	327	363	587	980
Agriculture	72	66	177	212	471	865
Steam-Electric	82	82	23	23	0	0
Manufacturing	102	102	43	43	31	30
Domestic	53	53	56	56	56	56
Commercial	15	15	15	15	14	14
Minerals	8	8	9	9	10	10
Public Lands	1	1	2	2	2	2
Fish Hatcheries	3	3	3	3	3	3
Other	0	0	0	0	0	0
Freshwater Consumption	112	108	202	230	446	753
Agriculture	63	58	149	176	387	694
Steam-Electric	1	1	0	0	0	0
Manufacturing	13	14	18	18	23	23
Domestic	25	25	25	25	25	25
Commercial	6	6	6	6	6	6
Minerals	3	3	3	3	3	3
Public Lands	1	1	2	2	2	2
Fish Hatcheries	0	0	0	0	0	0
Other	0	0	0	0	0	0
Ground Water Withdrawals	86	374	NE	142	NE	374
Reservoir Evaporation	11	40	11	55	11	97
Instream Approximation						
Fish and Wildlife	3,673	3,673	3,673	3,673	3,673	3,673

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

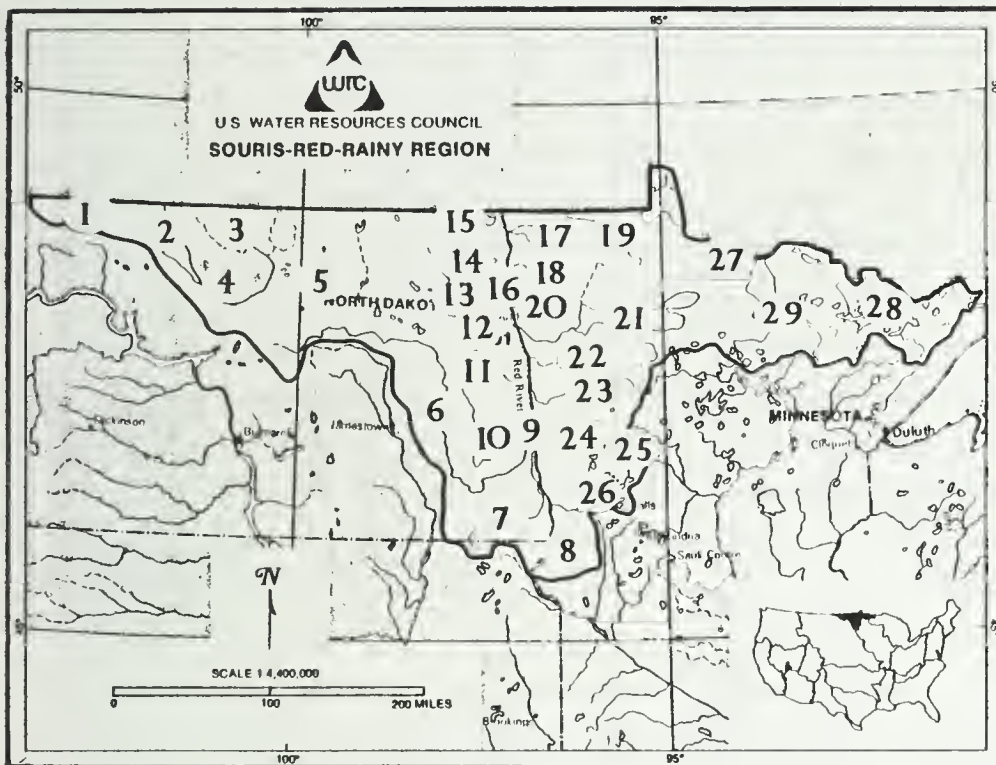
Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



SOURIS-RED-RAINY REGION

PROBLEM AREAS

1. Long Creek (North Dakota)
2. Glacial Lake Souris (North Dakota)
3. Lake Metigoshe (North Dakota)
4. Souris River Main Stem (North Dakota)
5. Devils Lake Basin (North Dakota)
6. Sheyenne River Basin (North Dakota)
7. Wild Rice River Basin (North Dakota and South Dakota)
8. Bois de Sioux - Mustinka River Basin
9. Red River Main Stem (Minnesota and North Dakota)
10. Lower Sheyenne, Maple, and Rush River Basins (North Dakota)
11. Goose River Basin (North Dakota)
12. Turtle River Basin (North Dakota)
13. Forest River Basin (North Dakota)
14. Park River Basin (North Dakota)
15. Pembina River Basin (North Dakota)
16. Red Lake River Basin and Red River Main Stem
17. Two Rivers Basin (Minnesota)
18. Tamarac River Basin (Minnesota)
19. Roseau River Basin (Minnesota)
20. Middle and Snake River
21. Upper Red Lake River Basin
22. Sand Hill River Basin (Minnesota)
23. North Branch of the Wild Rice - Marsh River (Minnesota)
24. South Branch of the Buffalo River (Minnesota)
25. Detroit Lakes (Minnesota)
26. Otter Tail River Basin (Minnesota)
27. Rainy River Main Stem (Minnesota)
28. B.W.C.A. - Voyageur National Park and Perimeter (Minnesota)
29. Little Fork - Big Fork River Basins (Minnesota)

FIGURE V- 26

FIGURE V-27
OCCURRENCE OF PROBLEM ISSUES BY
AGGREGATED SUBREGION AND PROBLEM AREAS —
SOURIS-RED-RAINY

Problem Issues	10	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Water Quantity																														
Fresh Surface		X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X											
Ground	O	X	X	X		X				X	X	X			X	X	X	X	X		X					X				
Marine & Estuarine																														
Surface/Depth			X			X		X	X	X	X		X	X	X	X	X	X	X	X	X		X	X	X				X	
Water Quality																														
Fresh Surface	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Ground	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Marine & Estuarine																														
Surface/Depth																														
Related Lands																														
Flooding	O		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Drainage	O			X		X	X				X	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
Erosion/Sediment			X	X		X			X	X	X	X				X	X	X	X		X	X	X	X	X	X	X	X	X	X
Dredge & Fill, Subsidence																														
Water Related Use Conflicts	O		X	X	X	X	X		X	X	X	X	X		X	X	X	X			X		X	X	X				X	X
Other		X						X						X	X							X								

O Problem Issues Identified by Federal Agency Representatives

X Problem Issues Identified by State-Regional Representatives

MISSOURI REGION

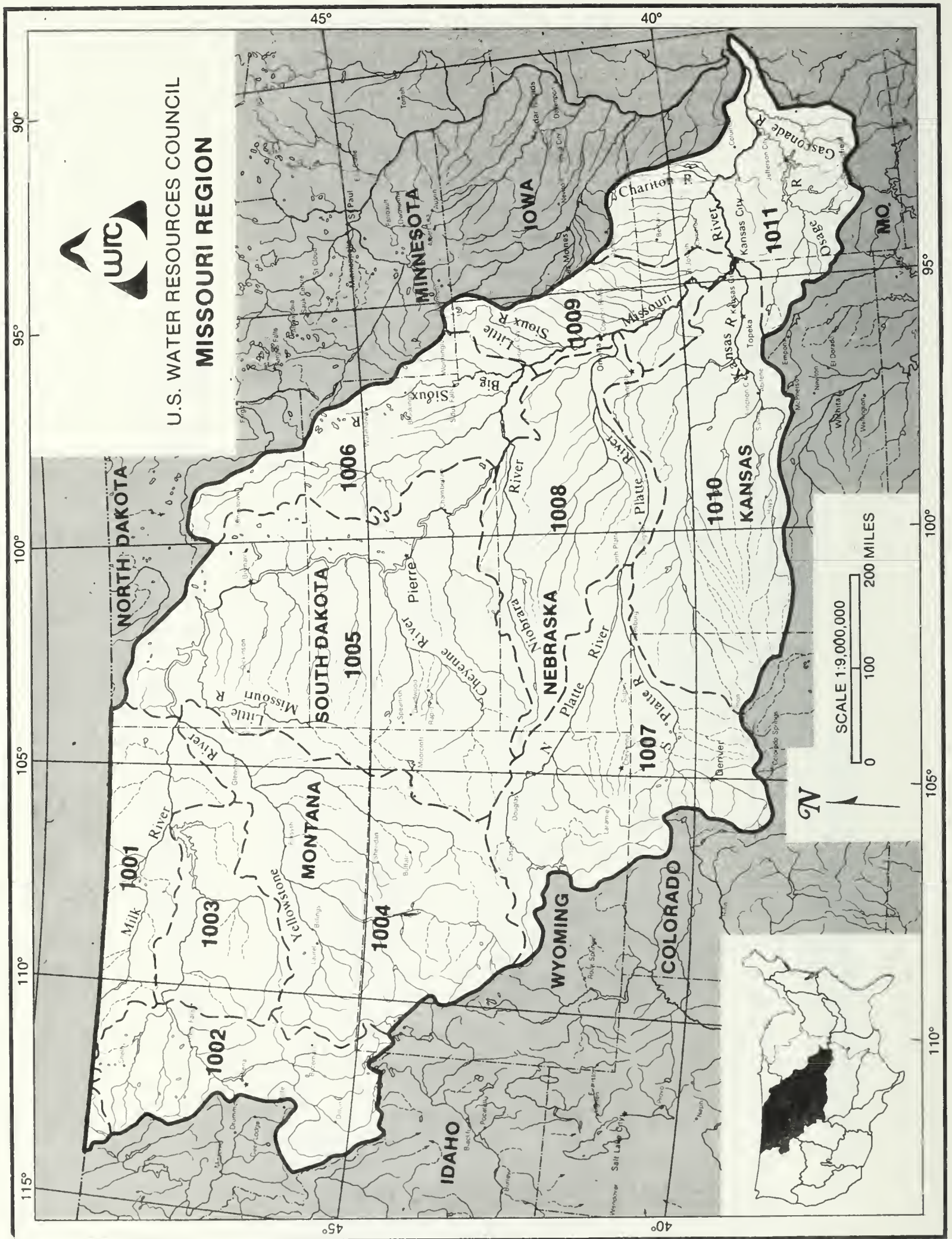


FIGURE V- 28

THE MISSOURI REGIONHighlights

- The Missouri Region contains one-sixth of the land area of the 48 contiguous states, about 511,309 square miles. There are few natural lakes; most of the Region's available water areas are found at manmade reservoirs. Six large reservoirs on the Missouri River main stem generate most of the Region's hydropower, maintain adequate flows for an 8-month navigation season and for water quality and water supply needs, and will divert water northeastward and eastward for irrigation as well as for municipal and industrial needs. Other tributary manmade reservoirs provide additional storage capacity and most of the water surface for water-oriented recreation as well as for fish and wildlife propagation and preservation.
- Increased competition for available water supplies indicates the need to examine current and projected water uses to assure efficiencies and an equitable distribution of available supplies. Water shortages occur at many locations throughout the Region during periods of low streamflow, and seven states in the Region are considered to have water-short areas.
- A great portion of the water consumed in the Region is used for irrigation. This situation will probably continue as the number of acres of land under irrigation has been increasing steadily and is expected to continue to grow.

- The Northern Great Plains of the Missouri Region contain large reserves of low-sulphur coal which probably will supply a significant portion of the country's energy in the future. Withdrawals for mining of fuels will increase from 144 MGD in 1975 to 236 MGD in 2000.
- There are numerous water and related land area problems throughout the Region. Because Indian and Federal reserved water rights have not been quantified, the uncertainty makes it difficult and sometimes impossible to plan for using and managing the available water supplies in large areas of the Region. The projected estimates of future water use indicate that, during extended drought periods, sufficient water to maintain navigation flows may not be available. The western streams are particularly susceptible to fluctuating streamflows since they are fed only by spring snowmelt and run off from erratic rainfall. At times the only streamflow results from reservoir releases or irrigation return flows. Sheet, gully, and streambank erosion result in the loss of valuable soils and lands at many locations, making silt the worst pollutant throughout the Region. Some communities suffer periodic flooding, and many suffer periodic water shortages. Non-point source pollution will continue to impair water quality.
- Seventeen water-related problems are discussed in the Missouri Regional Report (see Figure V-29). No geographic problem areas are identified by the Missouri Region. The federal viewpoint concerning the occurrence of problems by ASR is shown in Figure V-30.
- Conclusions and recommendations regarding the Federal role are discussed in the Missouri Regional Report. The Federal government should continue

to provide funding and should initiate and coordinate studies on several specific questions relating to problems in the Missouri Region.

Comparative Analysis

Table V-10 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows and water use in the Missouri Region.

The SRF data were developed by the 10 States and the 10 Federal agencies represented on the Missouri River Basin Commission (MRBC) to reflect the needs and objectives associated with the management, conservation, and development of the water and related land resources in the Region.

The amounts of water needed to meet the SRF projected irrigation and manufacturing requirements for the year 2000 are greater than those required by the NF projections. The amounts of water included in off-stream developments are significant throughout the Region. These amounts could impact seriously on the instream flows needed for power generation at the Federal hydroelectric projects, the Missouri River navigation project, riverine recreation, fish and wildlife, and water quality.

Table V-10

THE MISSOURI REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	8,832	9,067	9,298	10,046	10,044	11,762
Total Employment	3,695	3,936	4,084	5,061	4,573	5,759
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s)	44,100	44,195	37,427	NE	35,878	NE
Freshwater Withdrawals	38,016	35,860	48,030	44,706	44,354	48,724
Agriculture	32,086	28,461	39,935	34,231	36,894	39,325
Steam-Electric	3,540	4,966	5,834	7,313	4,938	5,445
Manufacturing	668	650	312	910	292	1,166
Domestic ^{1/}	961	1,264	1,045	1,666	1,161	2,055
Commercial	285	NA	306	NA	336	NA
Minerals	269	313	356	340	424	418
Public Lands	159	159	198	198	266	266
Fish Hatcheries	47	47	48	48	48	48
Other	0	0	0	0	0	0
Freshwater Consumption	15,463	15,830	19,203	20,305	19,910	25,679
Agriculture	14,664	14,750	18,156	18,741	18,265	23,342
Steam-Electric	68	66	239	217	637	576
Manufacturing	134	205	120	337	202	527
Domestic ^{1/}	262	537	280	695	303	831
Commercial	69	NA	72	NA	78	NA
Minerals	111	113	139	117	163	137
Public Lands	159	159	198	198	266	266
Fish Hatcheries	0	0	0	0	0	0
Other	0	0	0	0	0	0
Ground Water Withdrawals	10,407	4,196	NE	5,941	NE	8,371
Reservoir Evaporation	3,954	2,621	3,954	2,621	3,954	2,621
Instream Approximation						
Fish and Wildlife	33,958	33,958	33,958	33,958	33,958	33,958

^{1/} SRF domestic water use includes commercial and institutional requirements.

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.

Figure V-29

THE MISSOURI REGION
Water-Related Problems

1. Indian Water Rights
2. Federal Reserved Water Rights
3. Alternative Uses of Water
4. Current Water Availability and Use
5. Water for Energy
6. Ground Water and Surface Water Interrelationships
7. Interbasin and Interstate Water Transfers
8. Legal, Policy, and Institutional Problems
9. Funding Arrangements (Cost-Sharing)
10. Instream Flow Needs
11. Water Related Recreation Needs
12. Navigation Flow Requirements
13. Land Conservation and Erosion Control
14. Stream Bank Erosion and Channel Aggradation and Degradation
15. Flooding Problems and Flood Plain Management
16. Municipal and Industrial Water Needs
17. Water Quality and Low Streamflow Augmentation

MISSOURI

[illegible]

O Problem Issues Identified by Federal Agency Representatives
X Problem Issues Identified by State-Regional Representatives

* The Missouri Region did not identify any geographic problem areas.

ARKANSAS-WHITE-RED REGION

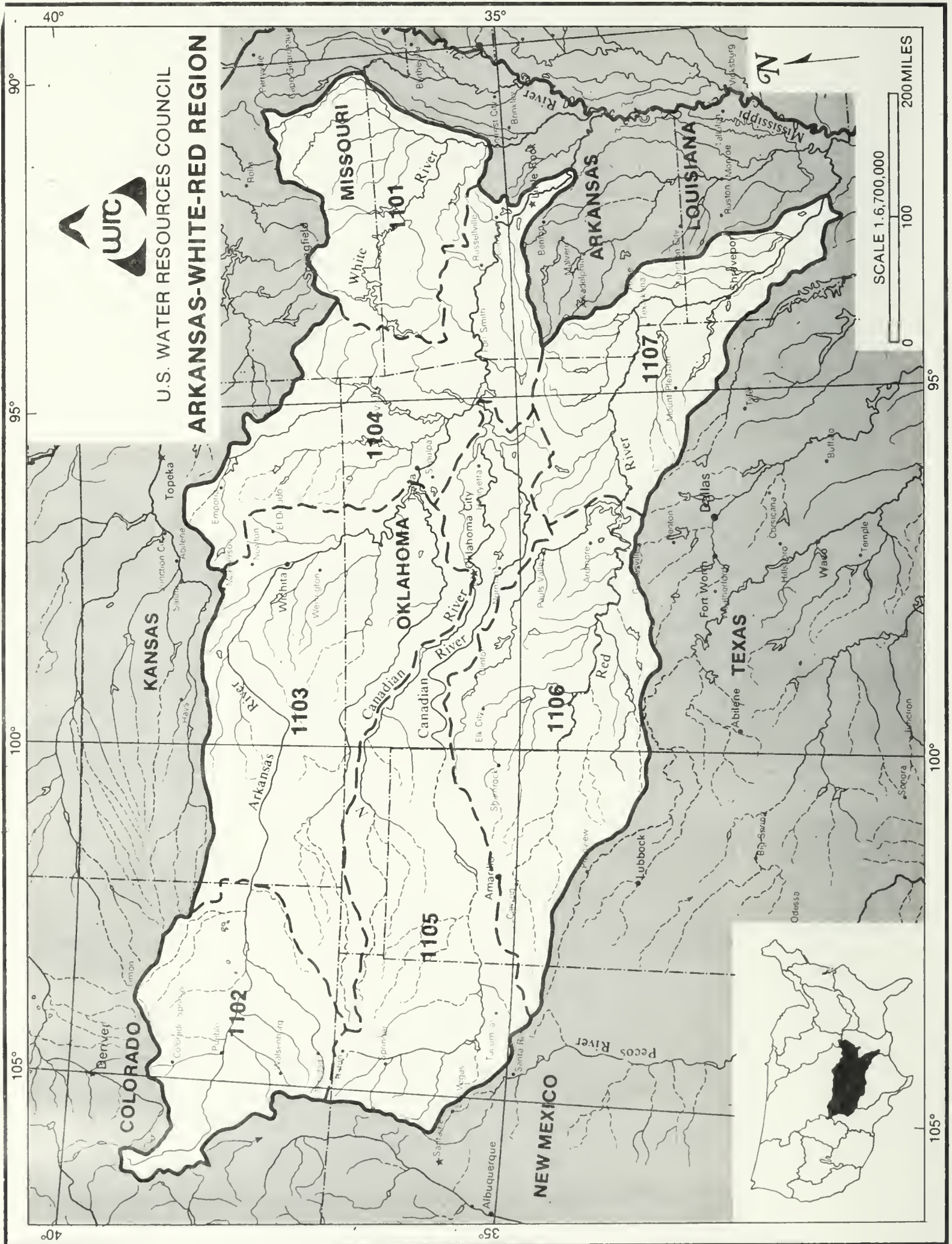


FIGURE V- 3 I

THE ARKANSAS-WHITE-RED REGIONHighlights

- The Arkansas-White-Red Region has an area of about 244,083 square miles. All three rivers discharge waters into the Mississippi River and drain all of Oklahoma and parts of Colorado, Kansas, Missouri, Arkansas, New Mexico, Texas, and Louisiana.
- The overall water supply outlook is one of cautious optimism, realizing that much water resource development will be needed to keep pace with growing needs under the rigorous conditions of water supply that prevail and under the criteria for maintaining wholesome environmental conditions. The quantity of water available in the western and central portions is inadequate for many requirements.
- Irrigation accounts for the largest portion of water withdrawals and consumptive use.
- Difficult water supply problems are experienced in the High Plains and central portion, and these will require cities and industries to change their pattern of water use to meet pollution discharge restrictions and to satisfy supply needs economically. In addition to water quantity limitations, there are concerns about water quality, erosion and sedimentation, flooding, and Indian water rights. The large irrigation water requirement often accentuates these problems by creating low streamflows and ground water depletions.

- Seventeen geographic problem areas are identified (see Figures V-32 and V-33).
- In the Arkansas-White-Red, the role of the Federal Government should be to provide assistance only if local and State authorities determine that they have no other solutions. Further Level B studies are not recommended at this time. Additional data collection and research are needed to supply information on ground and surface water considerations. To permit better utilization of water, various compacts between states are proposed. The states make separate conclusions and recommendations. (For more details see the Arkansas-White-Red Regional Chapter).

Comparative Analysis

Table V-11 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows and water needs in the Arkansas-White-Red Region.

The State-Regional Future data have been developed in the Region to reflect records and estimates of the eight States of the Region. The records from the States of Colorado, Kansas, Oklahoma, New Mexico, and Texas are pertinent to the administration of water rights under the Doctrine of Prior Appropriation. Accordingly, the SRF data on withdrawals and consumptive use in these five States must be considered.

In a number of cases, irrigation consumptive use and withdrawals differ substantially between SRF and NF data. Although the Region's problems are, for the most part, identified in both sources, the severity of some of the problems appears greater in the SRF estimates.

SRF estimates of manufacturing and steam-electric water withdrawals and consumption are consistently larger than the corresponding NF figures. The NF data show a greater proportion of water use in the minerals category than do those of regional sources.

Table V-11

THE ARKANSAS-WHITE-RED REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	6,846	7,350	7,268	8,321	7,815	9,819
Total Employment	2,670	1,565*	2,987	1,965*	3,369	2,530*
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s)	62,600	62,605	56,193	NE	55,897	NE
Freshwater Withdrawals	12,867	13,551	13,797	16,434	13,333	22,622
Agriculture	10,195	9,827	10,721	11,737	10,055	16,056
Steam-Electric	498	1,297	1,026	2,032	1,012	3,233
Manufacturing	714	956	476	989	478	1,268
Domestic <u>1/</u>	735	1,060	807	1,321	894	1,645
Commercial	210	NA	221	NA	238	NA
Minerals	448	200	469	142	571	206
Public Lands	26	30	33	32	39	36
Fish Hatcheries	43	NE	46	NE	48	NE
Other	0	180	0	177	0	178
Freshwater Consumption	8,062	9,433	8,766	11,611	8,886	16,405
Agriculture	7,263	8,379	7,706	10,221	7,404	14,422
Steam-Electric	89	126	237	285	457	577
Manufacturing	165	347	233	407	358	562
Domestic <u>1/</u>	279	466	305	591	331	710
Commercial	69	NA	72	NA	78	NA
Minerals	173	70	184	67	218	90
Public Lands	26	27	33	30	39	34
Fish Hatcheries	0	NE	0	NE	0	NE
Other	0	17	0	10	0	10
Ground Water Withdrawals	8,846	6,968	NE	NE	NE	NE
Reservoir Evaporation	1,898	10,179**	1,898	11,330**	1,898	12,388**
Instream Approximation						
Fish and Wildlife	46,169	NE	46,169	NE	46,169	NE

* Total includes only ASRs 1101, 1102, 1105, 1106, and 1107. Data was not available for ASRs 1103 and 1104.

** Total does not include ASR 1102 for which data was not available.

1/ SRF domestic water use includes commercial and institutional requirements.

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

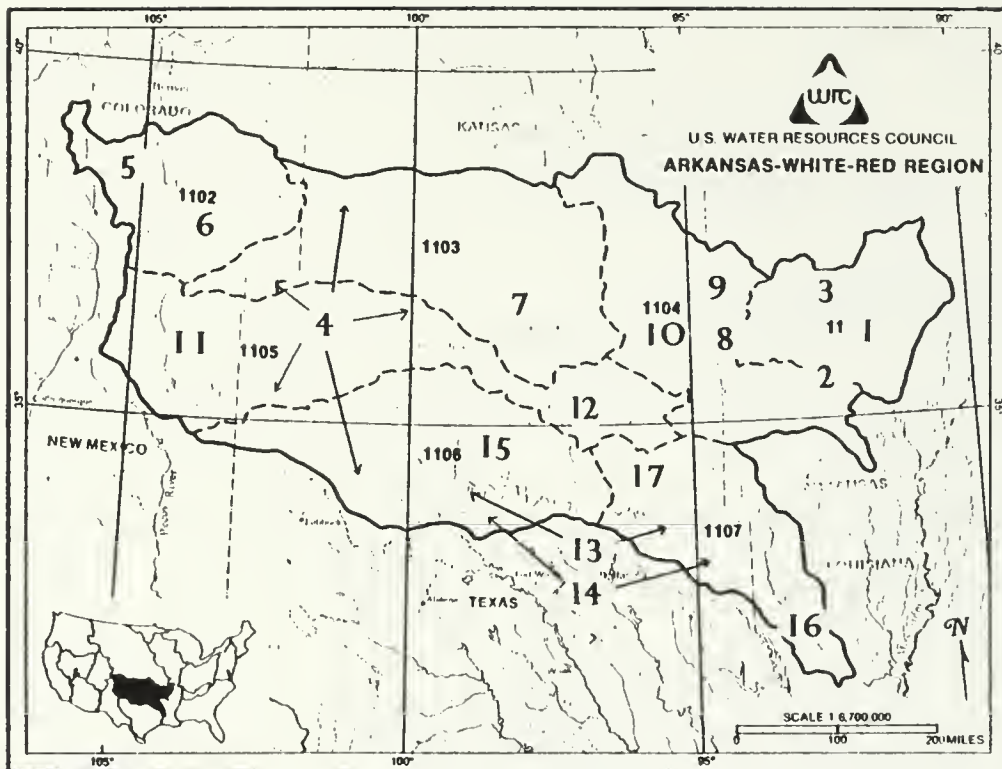
Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



ARKANSAS-WHITE-RED REGION

PROBLEM AREAS

- | | |
|---|--|
| 1. Ozarks Area, ASR 1101, Arkansas | 9. Joplin Area, Missouri |
| 2. Arkansas, Statewide | 10. ASR 1104, Oklahoma |
| 3. Springfield Area, Missouri | 11. ASR 1105, New Mexico |
| 4. High Plains Groundwater Irrigation (5 States) | 12. ASR 1105, Oklahoma |
| 5. Arkansas Drainage above Pueblo, ASR 1102, Colorado | 13. Flooding and Related Problems Texas |
| 6. Arkansas Drainage, Pueblo to Kansas, in Colorado | 14. Water Supply & Quality Problems, Texas |
| 7. ASR 1103, Oklahoma | 15. ASR 1106, Oklahoma |
| 8. Ozarks Areas, Benton and Washington Counties, Arkansas | 16. Red River Area in Louisiana |
| | 17. ASR 1107, Oklahoma |

FIGURE V- 32

FIGURE V-33
OCCURRENCE OF PROBLEM ISSUES BY
AGGREGATED SUBREGION AND PROBLEM AREAS*—
ARKANSAS-WHITE-RED

Problem issues	1101	1	2	3	1102	4	5	6	1103	4	7	1104	8	9	10	1105	4	11	12	13	14	1106	4	15	13	14	1107	2	16	17	13	14
Water Quantity																																
Fresh Surface		X	X	X		X	X		0		X	0	X	X	X			X	X		X			X		X		X	X		X	
Ground		X		X	0		X		0	X	X		X	X		0	X	X	X		X	0	X	X	X	X			X	X		X
Marine & Estuarine																																
Surface/Depth						X	X								X								X					X				
Water Quality																																
Fresh Surface				X	0	X	X		0		X	0	X	X	X	0			X	X		X		X		X		X	X		X	
Ground		X	X	X							X	X	X	X				X	X	X		X		X		X		X	X		X	
Marine & Estuarine																																
Surface/Depth																																
Related Lands																																
Flooding	0	X	X	X		X	X		0		X	0	X		X			X	X	X		0	X	X	X	X		X	X	X	X	
Drainage		X		X							X	X	X						X	X								X	X			
Erosion/Sediment								X	0			0	X		X			X	X	X		0			X			X	X	X	X	
Dredge & Fill, Subsidence															X																	
Water Related Use Conflicts			X	X		X									X			X							X					X	X	
Other					0	X	X	X	0			0			X	0	X		X	X						X		X	X	X	X	

O Problem Issues Identified by Federal Agency Representatives

X Problem Issues Identified by State-Regional Representatives

* Problem areas 2,4,13, and 14 occur in more than one ASR.

TEXAS-GULF REGION

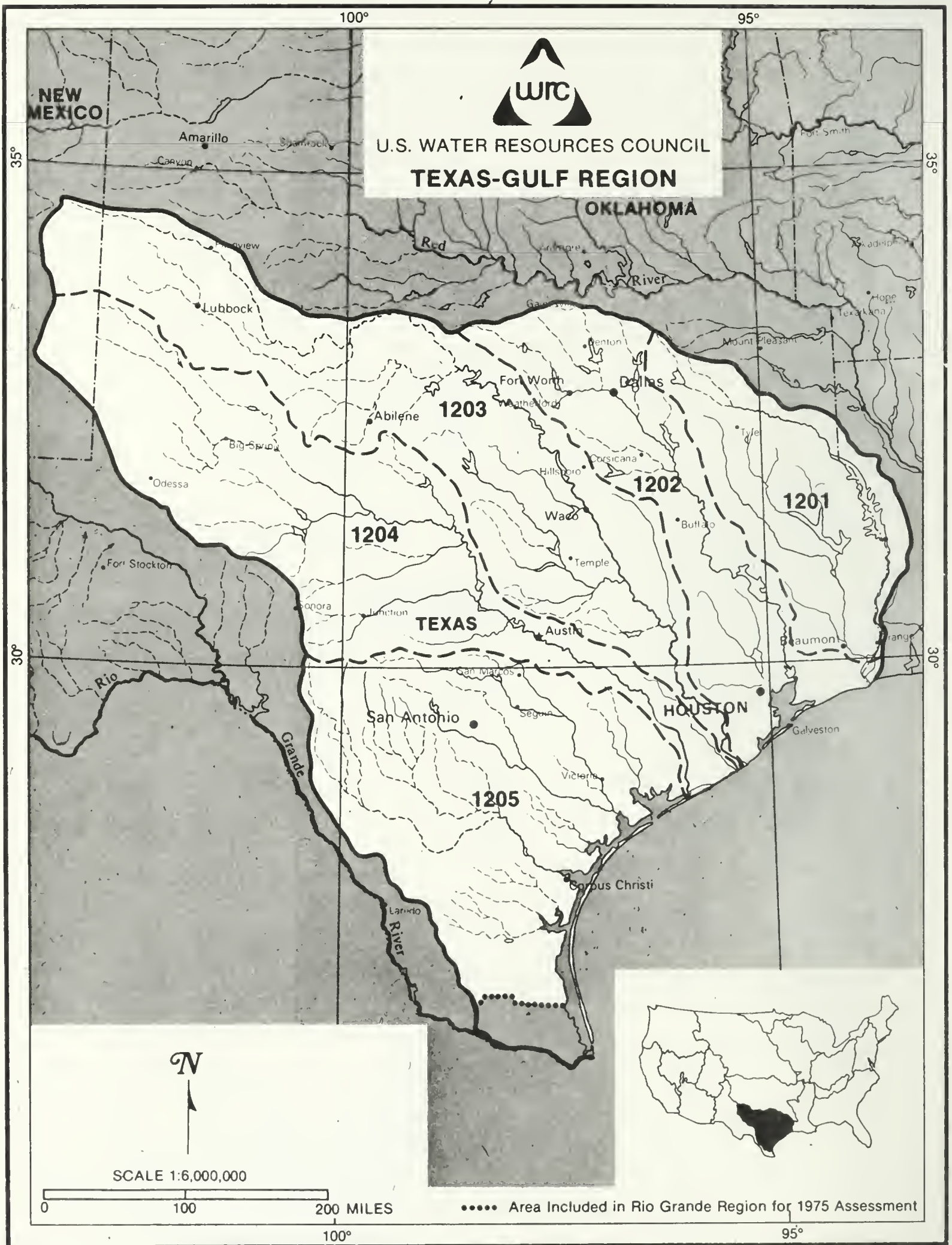


FIGURE V-34

THE TEXAS-GULF REGIONHighlights

- The Texas-Gulf Region extends for about 177,754 square miles. Virtually all of the Region lies within Texas, although small portions of Louisiana and New Mexico are included. Much of the Region consists of the drainage areas of the Sabine, Neches, Trinity, San Jacinto, Brazos, Colorado, Lavaca, Guadalupe, San Antonio, and Nueces Rivers associated coastal basins. These rivers drain in a general northwest-southeast course to the Gulf of Mexico. The ports in the Texas-Gulf Region are among the busiest in the Nation.
- Historically, ground water has supplied an appreciable percentage of total water supply requirements. Because pumpage exceeds natural recharge in most aquifers, however, the Region will become increasingly dependent on surface water supplies. In many areas, especially in the western portion of the Region, water supply will become critical.
- Irrigated agriculture uses largest amount of water withdrawals.
- In much of the Texas-Gulf Region there is little excess storage capacity in surface water reservoirs to meet water demands during drought. Coupled with declining ground water resources, this could result in serious supply shortages. In addition to supply limitations, problems of water quality, flooding, drainage, erosion and sedimentation, inadequate water-oriented

recreation opportunities, and land subsidence and fault activation occur. Estuarine management is needed to assure sufficient freshwater inflows at appropriate geographic locations. Similarly, water resources management must ensure proper distribution of supply with respect to need.

- Twenty geographic problem areas are identified (see Figures V-35 and V-36).
- In the Texas-Gulf Region, the Federal government should assist in the resolution of problems having regional or national significance and should formulate a national water policy that preserves the sovereignty of States with regard to water laws. The Texas Water Plan, currently being updated, remains the official guide to state policy and seeks to reach a mutually responsible relationship between Federal and state water agencies. Funding is deemed necessary for water resource projects and research and technology development programs. (For details see the Texas-Gulf Regional Report).

Comparative Analysis

Tables V-12 and V-13 present a comparison of the National Future (NF) and State-Regional Future (SRF) with regards to estimates of stream-flows and water use in the Texas-Gulf Region. The dry year volumetric comparisons between SRF data and NF data are indicated in Table V-12. Comparative data for mean annual conditions are provided in Table V-13. The SRF did not develop average year data for withdrawals and consumption.

The NF developed average and dry year values for irrigation requirements only; average and dry year conditions were not evaluated for the remaining functional use categories. Substantial differences exist between SRF data and NF data.

In 1975, under dry year conditions, total NF withdrawals exceed total SRF withdrawals by 7,789 MGD, primarily due to differences in water withdrawals for irrigation, manufacturing, and mining. Total NF consumption exceeds total SRF consumption by 4,303 MGD in 1975. It appears that the difference in irrigation data accounts for most of the discrepancy in total consumption between the SRF and the NF.

Significant differences also appear in the percentages of withdrawals consumed for domestic, steam-electric power generation, and irrigation uses. For each of these uses, the percentage of withdrawals consumed is significantly lower for the NF data. On the whole, the SRF data indicate about 78 percent of the withdrawals are consumed, while the NF data indicate about 68 percent.

Total SRF withdrawals for dry year conditions projected for the year 2000 exceed total NF withdrawals by 593 MGD, due primarily to differences in domestic, manufacturing, mining and irrigation withdrawal projections. Total SRF consumption exceeds total NF consumption by 1,194 MGD, due primarily to differences in domestic, manufacturing, mining and irrigation uses.

On the whole, consumptive use as a share of withdrawal for SRF data for 2000 is about 74 percent, while the NF data indicate a share of approximately 69 percent. Consumptive use as a percentage share of withdrawal for major users are as follows:

1. NF consumptive use for domestic uses remains at about 34 percent during the period 1975 to 2000, while SRF consumptive use remains about 56 percent during the same period.
2. NF consumptive use for manufacturing increases from 30 percent in 1975 to 78 percent by the year 2000, while SRF data indicate an increase from 33 percent to 47 percent during the same period.
3. NF consumptive use for irrigation remains at about 82 percent during the period 1975 to 2000, while SRF consumptive use for irrigation remains at about 90 percent.

Consequently, although both SRF data and NF data indicate an increase in water use efficiency among manufacturing industries, the NF data indicate a much greater increase. There does not appear to be much change in the SRF and NF ratios for domestic and irrigation uses.

The SRF present modified flow^{1/} is 6,220 MGD. The NF present modified flow is 12,266 MGD for a dry year, as compared to 28,270 MGD for an average year. Basically, the same methodology was used for both the SRF and NF to analyze the flow characteristics at the farthest downstream gaging station(s) in each ASR in the Texas-Gulf Region and to compute the ungaged runoff below the farthest downstream gaging station(s) in order to derive the present modified flow. However, the SRF and NF analyses were performed independently of each other. Consequently, the difference between the SRF and NF present modified flows is most probably due to inconsistency in the selection of the periods of record for the streamflow data.

^{1/} Present Modified Flow-Streamflow at the outflow point.

Table V-12

THE TEXAS-GULF REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	9,911	10,359	11,162	12,311	12,907	15,857
Total Employment	4,109	3,960	4,827	4,752	5,767	5,318
VOLUMETRIC DATA (mgd) - Dry Year Conditions-						
Streamflow at Outflow Point(s)	12,266	6,220*	7,789**	NE	7,570**	NE
Freshwater Withdrawals	18,299	10,510	17,026	13,212	16,398	16,991
Agriculture	13,091	7,397	10,628	8,230	8,515	9,499
Steam-Electric	724	296	1,000	712	2,262	1,508
Manufacturing	1,931	1,177	2,560	1,466	2,443	2,273
Domestic <u>1/</u>	1,207	1,427	1,380	2,556	1,621	3,379
Commercial	283	NA	317	NA	300	NA
Minerals	1,044	194	1,133	234	1,245	284
Public Lands	<1	19	2	14	2	15
Fish Hatcheries	17	NE	11	NE	11	NE
Other	0	<1	0	<1	0	33
Freshwater Consumption	12,464	8,161	11,193	10,005	11,296	12,490
Agriculture	10,730	6,726	8,761	7,487	7,094	8,558
Steam-Electric	99	149	270	357	994	752
Manufacturing	572	387	1,003	551	1,915	1,073
Domestic <u>1/</u>	413	794	467	1,485	541	1,936
Commercial	94	NA	103	NA	118	NA
Minerals	555	100	588	119	632	146
Public Lands	<1	NE	2	NE	2	NE
Fish Hatcheries	0	NE	0	NE	0	NE
Other	0	5	0	6	0	24
Ground Water Withdrawals	7,222	7,172	NE	4,961	NE	3,398
Reservoir Evaporation	1,289	1,743	1,289	1,964	1,289	1,972
Instream Approximation						
Fish and Wildlife	22,917	NE	22,917	NE	22,917	NE

* SRF estimate is at 95% probability.

** ASRs 1203 and 1204 demands may exceed ASR water supply in future dry years.

1/ SRF domestic water use includes commercial and institutional requirements.

Table V-13

THE TEXAS-GULF REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	9,911	10,359	11,162	12,311	12,907	15,857
Total Employment	4,109	3,960	4,827	4,752	5,767	5,318
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s)	28,270	26,368	23,559	NE	23,137	NE
Freshwater Withdrawals	16,925	NE	15,930	NE	15,538	NE
Agriculture	11,718	NE	9,530	NE	7,655	NE
Steam-Electric	724	NE	1,000	NE	2,262	NE
Manufacturing	1,931	NE	2,560	NE	2,443	NE
Domestic	1,207	NE	1,380	NE	1,621	NE
Commercial	283	NE	317	NE	300	NE
Minerals	1,044	NE	1,133	NE	1,245	NE
Public Lands	<1	NE	2	NE	2	NE
Fish Hatcheries	17	NE	11	NE	11	NE
Other	0	NE	0	NE	0	NE
Freshwater Consumption	11,262	NE	10,225	NE	10,530	NE
Agriculture	9,527	NE	7,794	NE	6,328	NE
Steam-Electric	99	NE	270	NE	994	NE
Manufacturing	572	NE	1,003	NE	1,915	NE
Domestic	413	NE	467	NE	541	NE
Commercial	94	NE	103	NE	118	NE
Minerals	555	NE	588	NE	632	NE
Public Lands	<1	NE	2	NE	2	NE
Fish Hatcheries	0	NE	0	NE	0	NE
Other	0	NE	0	NE	0	NE
Ground Water Withdrawals	7,222	7,172	NE	4,961	NE	3,398
Reservoir Evaporation	1,289	1,743	1,289	1,964	1,289	1,972
Instream Approximation						
Fish and Wildlife	22,917	NE	22,917	NE	22,917	NE

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

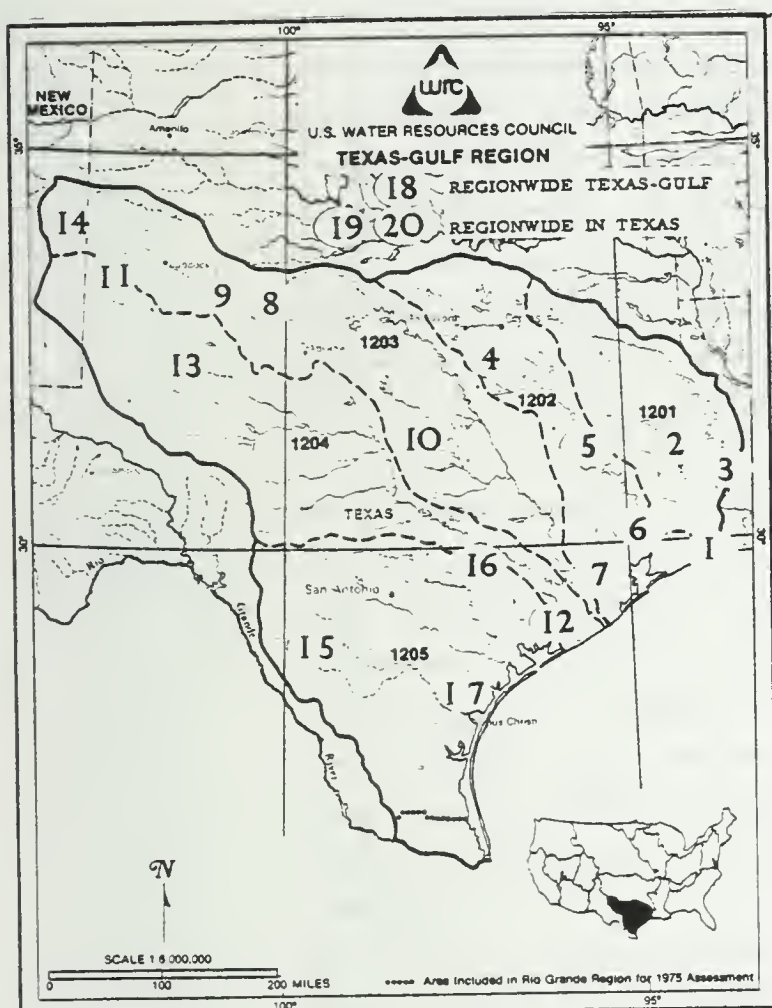
Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



TEXAS-GULF REGION

PROBLEM AREAS

1. Water Quality Problems -- Beaumont-Port Arthur Metropolitan Area (Texas)
2. Pollution, Recreation, Flooding and Salt Water Intrusion Problems (Louisiana)
3. Water Supply, Flooding, and Erosion Problems (Louisiana)
4. Water Supply Problems -- Upper Trinity River Basin (Texas)
5. Water Quality Problems -- Dallas-Fort Worth (Trinity River and Tributaries) (Texas)
6. Land Subsidence in the Houston Metropolitan Area (Texas)
7. Water Quality Problems - Houston Metropolitan Area (Texas)
8. Ground Water Quality Problems Haskell and Jones Counties (Texas)
9. Brazos Basin Salinity Problems above Possum Kingdom Reservoir (Texas)
10. Water Supply Problems in the Mid-Brazos River Basin (Texas)
11. Ground Water Depletion Problems in Texas High Plains (Texas)
12. Jackson County and Vicinity Ground Water Problems (Texas)
13. Upper Colorado River Salinity Problems (Texas)
14. Water Supply and Related Problems in Curry, Roosevelt and Lea Counties (New Mexico)
15. Ground Water Availability and Quality Problems in the Carrizo Aquifer, Winter Garden Area (Texas)
16. Regional Ground and Surface Water Management Problems Associated with the Edwards (Balcones Fault Zone) Aquifer (Texas)
17. Water Supply Problems in the Corpus Christi Metropolitan Area (Texas)
18. Problems Associated with the Freshwater Inflows to the Texas Bays and Estuaries (Texas)
19. Water Supply and Quality Problems in Small Cities and Rural Communities as a Consequence of Implementing the 1974 Safe Drinking Water Act
20. Flood Problems and Hurricanes (Texas)

FIGURE V-35

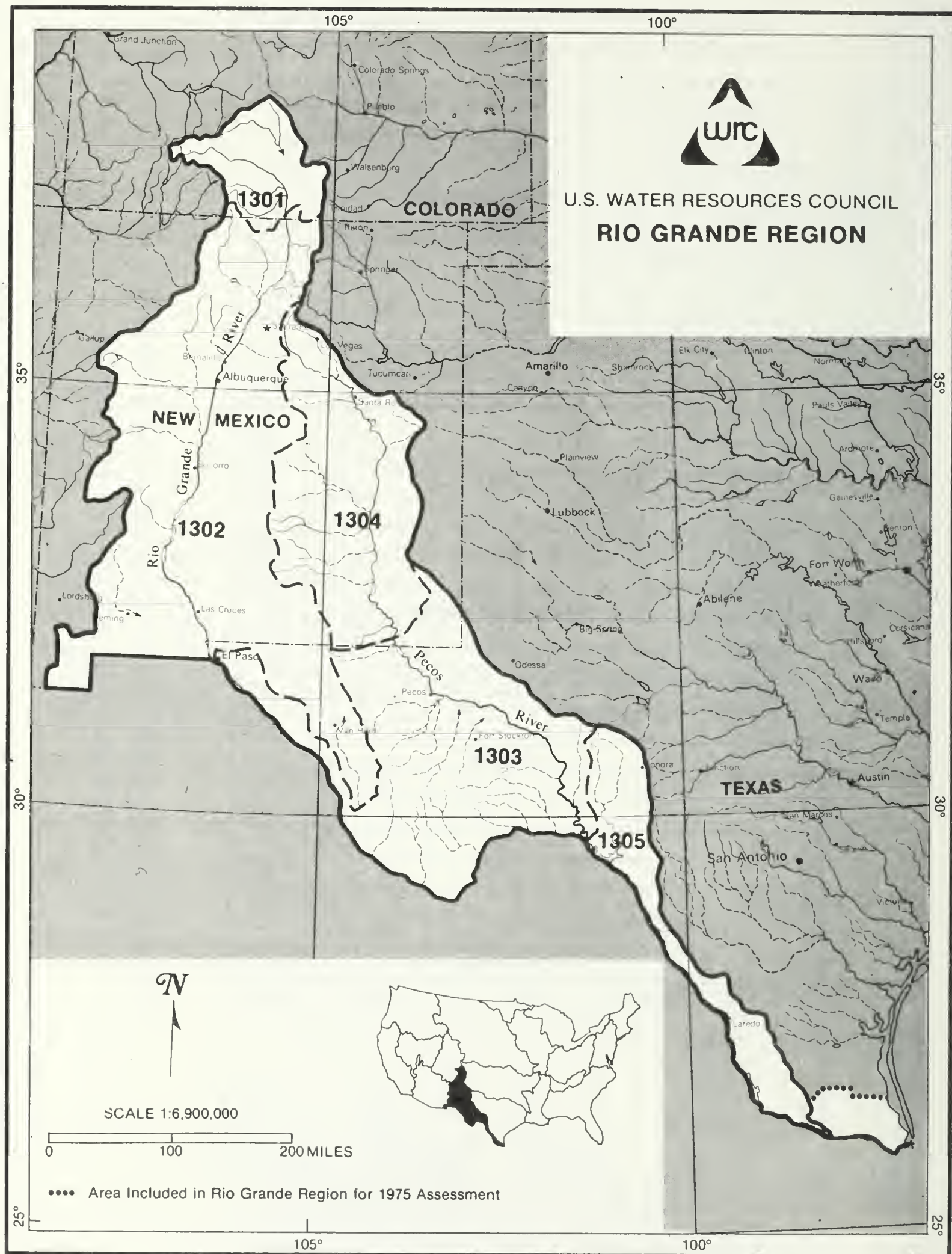
FIGURE V-36
OCCURRENCE OF PROBLEM ISSUES BY
AGGREGATED SUBREGION AND PROBLEM AREAS —
TEXAS-GULF

Problem Issues	1201	1	2	3	4	5	6	7	1203	8	9	10	11	1204	12	13	14	1205	15	16	17	18	*19	20
Water Quality																								
Fresh Surface			X	X	X		X										X	X		X		X		
Ground					X		X		O			X	X				X	X	O	X	X		X	
Marine & Estuarine	O					X																X		
Surface/Depth																								
Water Quality																								
Fresh Surface	X					X	X	X	O		X						X		O	X	X	X	X	
Ground	X					X	X	X		X		X					X	X		X	X		X	
Marine & Estuarine	O	X						X														X		
Surface/Depth																								
Related Lands																								
Flooding	O		X	X	O		X		O								X				X	X	X	
Drainage							X			X						X								
Erosion/Sediment	O	X	X	X	O		X	X									X	X	O		X	X		
Dredge & Fill, Subsidence	X						X	X								X						X		
Water Related Use Conflicts														O								X		
Other			X			X	X			X									X	X	X			
O Problem Issues Identified by Federal Agency Representatives																								
X Problem Issues Identified by State-Regional Representatives																								

* Regionwide in Texas-Gulf

** Regionwide in Texas

RIO GRANDE REGION



THE RIO GRANDE REGIONHighlights

- The Rio Grande Region, in the southwest corner of the United States, has a total area of about 137,175 square miles. The Rio Grande River flows south-southeasterly to the Gulf of Mexico; its waters are regulated by various treaties and compacts between the United States and Mexico and among Colorado, New Mexico, and Texas. Closed basins are an important factor in the Region's hydrology.
- Ground water is an important segment of the water supply, which will be under additional stress due to increasing population in the future. There is no surplus water for new or expanding current uses. The existing supply is completely appropriated by current demands.
- Irrigation is the major water consumer. Shifts will be from irrigation to other uses in the future, but still it is projected to remain the largest consumptive use.
- Shortages exist in meeting current needs, making conservation a necessity. Ground water depletions are anticipated along with salinity problems that are caused from reuse of water in the basin. Dissolved and suspended solids are major pollutants degrading water quality. Other problems involve erosion and sedimentation, flooding, unsatisfactory domestic water supplies (under the 1974 Safe Drinking Water Act), and needs for more water-based recreation opportunities.

- Fourteen geographic problem areas are identified (see Figures V-38 and V-39).
- General conclusions and recommendations are made regarding the need for storage and regulating works to amend water supply shortages and the need for a comprehensive water quality improvement program to relieve salinity problems. No Level B Studies are recommended. The Rio Grande supports a land development program emphasizing environmental concerns. Specific conclusions and recommendations are made by Colorado, New Mexico, and Texas. (For details see the Rio Grande Regional Report).

Comparative Analysis

Table V-14 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows and water use in the Rio Grande Region.

Comparisons of the State-Regional Future (SRF) with the National Future (NF) illustrate that some significant differences occur in many functional use categories because sources of data as well as assumptions and criteria used in compiling the data were different. In some cases the trends or magnitudes of the data reveal that potential problems relating to growth, recession, or magnitude of water requirements do exist even though there are differences in the basic estimates from the two sources.

Table V-14

THE RIO GRANDE REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	1,695	1,877	1,780	2,678	1,875	3,630
Total Employment	599	620	659	792	732	1,017
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s)	1,230	1,228	427	NE	707	NE
Freshwater Withdrawals	6,318	6,031	6,199	6,794	5,630	7,198
Agriculture	5,722	5,540	5,537	5,999	4,917	6,049
Steam-Electric	34	24	16	30	10	76
Manufacturing	19	24	41	31	32	42
Domestic ^{1/}	265	345	287	566	312	801
Commercial	62	NA	65	NA	68	NA
Minerals	190	44	221	86	255	133
Public Lands	22	11	27	14	28	14
Fish Hatcheries	7	NE	9	NE	11	NE
Other	0	43	0	68	0	83
Freshwater Consumption	4,240	3,863	4,320	4,406	4,017	5,119
Agriculture	3,924	3,569	3,959	3,890	3,614	4,358
Steam-Electric	18	18	9	23	5	62
Manufacturing	5	10	15	13	24	20
Domestic ^{1/}	139	195	151	352	164	505
Commercial	30	NA	31	NA	32	NA
Minerals	103	24	129	52	150	86
Public Lands	22	12	27	16	28	16
Fish Hatcheries	0	NE	0	NE	0	NE
Other	0	35	0	60	0	72
Ground Water Withdrawals	2,335	1,722	NE	1,621	NE	1,538
Reservoir Evaporation	653	606	653	623	653	616
Instream Approximation						
Fish and Wildlife	2,287	NE	2,287	NE	2,287	NE

^{1/} SRF domestic water use includes commercial and institutional requirements.

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

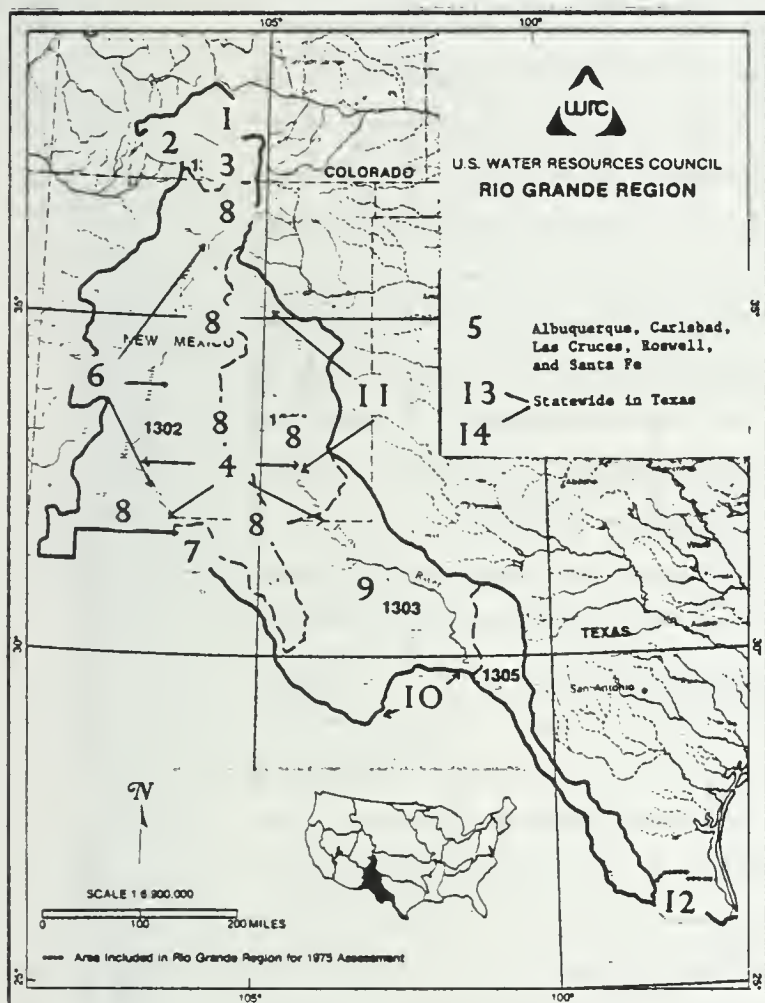
Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



RIO GRANDE REGION

PROBLEM AREAS

ASR 1301-Rio Grande Headwaters

1. San Luis Valley Closed Basin
2. Hinsdale, Rio Grande, and Mineral Counties
3. Del Norte, Colorado, to Colorado-New Mexico State Line

ASR 1302-Middle Rio Grande

4. Rio Grande Basin in New Mexico
5. Albuquerque, Carlsbad, Las Cruces, Roswell, and Santa Fe, New Mexico
6. Espanola Valley and Rio Grande west side tributaries
7. El Paso area
8. Roswell Artesian Basin, Sunshine Valley, Estancia Basin, Carrizozo, Nutt-Hockett area, and Mimbres Underground Basin

ASR 1303-Big Bend

9. Trans-Pecos region of Texas
10. Rio Grande Canyons, Texas

ASR 1304-Upper Pecos

4. Rio Grande Basin in New Mexico
5. Albuquerque, Carlsbad, Las Cruces, Roswell, and Santa Fe, New Mexico
8. Roswell Artesian Basin, Sunshine Valley, Estancia Basin, Carrizozo, Nutt-Hockett area, and Mimbres Underground Basin

11. Pecos River downstream from Santa Rosa, New Mexico

ASR 1305-Lower Rio Grande

12. Lower Rio Grande Valley

ASRs 1302, 1303, and 1305

13. Texas state wide- Water supply and quality problems in small cities and rural communities
14. Texas state wide- Flood problems and Hurricanes

FIGURE V- 38

Problem Issues	1301	1	2	3	1302	4	5	6	7	8	1303	9	10	1304	4	5	8	11	1305	12	**	1314
Water Quantity																						
Fresh Surface	0	X	X	0	X	X	X				0	X		0	X	X			0	X		X
Ground	0			0	X	X	X		X	X	0	X		0	X	X	X		0	X		X
Marine & Estuarine																						
Surface/Depth					X										X							
Water Quality																						
Fresh Surface		X	X	0							0	X		0			X	X	0	X		X
Ground				0					X	X	0	X		0			X		0			X
Marine & Estuarine																			0			
Surface/Depth																						
Related Lands																						
Flooding	0		X	0	X			X							X				0			X
Drainage																						
Erosion/Sediment					X			X							X			X				
Dredge & Fill, Subsidence																						
Water Related Use Conflicts	X	X	X		X										X							
Other	0	X		0	X	X	X	X			0		X	0	X	X		X	0			

O Problem Issues Identified by Federal Agency Representatives
X Problem Issues Identified by State-Regional Representatives

* Problem areas 4, 5, and 8 occur in ASRs 1302 and 1304.

** Problem areas 13 and 14 are regionwide in Texas: ASRs 1302, 1303, and 1305.

UPPER COLORADO REGION

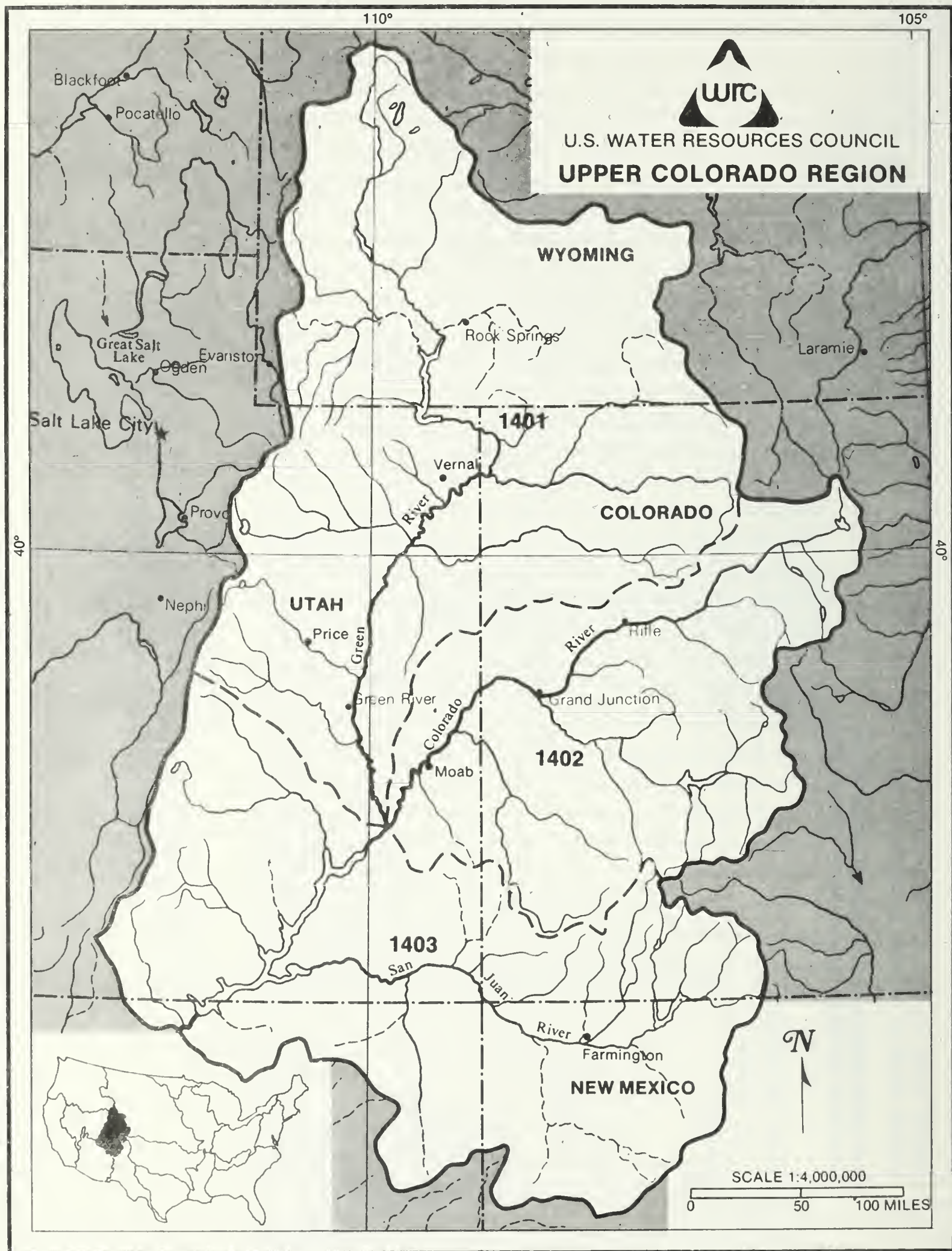


FIGURE V-40

THE UPPER COLORADO REGIONHighlights

- The Upper Colorado Region contains about 102,920 square miles in Arizona, Colorado, New Mexico, Utah, and Wyoming. The Colorado River and its tributaries are the life blood of the Region. The allocation and use of water in the Region are governed by various interstate and international treaties and compacts. A number of reservoirs have been constructed to regulate the erratic streamflows and to provide water for irrigation, municipal, industrial, and other uses and to meet compact commitments to the Lower Colorado Region.
- Ample water and land resources are available to meet the needs of an expanding economy and a quality environment for the next quarter of a century. Beyond that time period, water supplies likely will be insufficient to satisfy the demands of an expanding economy. The Colorado River is approaching the time when it will be unable to supply the demands placed on it.
- Agriculture accounts for the largest use of water withdrawals and consumption.
- Large amounts of bituminous coal, oil shale, tar sands, and uranium are located in all five states of the Upper Colorado Region. Water withdrawals for mineral fuels are projected to increase from 68 MGD in 1975 to 171

MGD in 2000. The utilization of the fuel reserves depends largely on Federal leasing and development policies as much of the resources are located on public lands.

- The water supply in the Upper Colorado is not sufficient to meet projected needs and terms of the Colorado River Compact. Other supply-related problems revolve around the need for improved domestic water sources and increased water requirements for mineral extraction and processing and for agricultural purposes. Excess salinity and sedimentation are two water quality concerns that must be solved. Conflicts exist among various water consumers, such as domestic, industrial, and agricultural users.
- Six geographic problem areas are identified (see Figures V-41 and V-42).
- The role of the Federal government in the resolution of particular problems in the Upper Colorado, such as excess salinity and erosion, is described in the Upper Colorado Regional Report. No Level B Studies are recommended and no special data and research needs are identified. The uncertainty over Indian water rights is a major institutional concern that must be resolved. (For more detail see the Upper Colorado Regional Report).

Comparative Analysis

Table V-15 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows and water use in the Upper Colorado Region.

The NF values do not recognize the increased use of domestic water to satisfy the large population increase since 1970, and, therefore, the estimate for present domestic plus commercial use is about 25 MGD less than the SRF. The SRF projects a 61 percent population increase between 1975 and 2000 while the NF projects only a 7 percent increase. The need for domestic water will be determined by the population growth. If the increase of population as projected in the SRF is attained, the need for domestic water supplies will almost double to 201 MGD by 2000.

The amount of water required to meet the SRF projected need for mineral fuels extraction and processing and steam-electric generation is generally much greater than that shown by the NF projections. The NF did not project any significant development of mineral fuels in this Region. The decisions relating to the use of water for these purposes will depend largely upon a national policy on energy use and conservation that is still to be formulated and adopted. If domestic production is encouraged through control of oil and natural gas imports, market place pricing, and production incentives, it is reasonable to expect that the mineral fuels of the Region will be utilized, and the SRF estimates of water consumption for oil shale processing, coal gasification, and steam-electric generation will be equalled or exceeded by 2000.

Consumptive use for irrigated agriculture in 1975 is 12 percent less for the SRF than the NF. The SRF values are those generally accepted by the States of the Upper Colorado River Basin and reflect their best judgment of average depletions under the present level of development of the river system.

Projections of future irrigation use consumption are larger for the NF than for the SRF. The NF projects a full supply for all irrigated land (1,627 thousand acres) by 2000. On the other hand, the SRF indicates that only about 60 percent of the water-short lands will be fully supplied with the view that there is no practical way to fully supply some of these lands. The NF projection of new irrigated lands is based on the Region meeting a share of the Nation's projected needs for food and fiber. SRF projections are based on presently authorized projects. The National Future estimates for public lands and fish and wildlife needs for instream flows help to further explain water supply problems in the Region.

Table V-15

THE UPPER COLORADO REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	344	431	357	543	368	693
Total Employment	128	168	140	213	150	288
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s)	10,000	10,077	9,233	NE	8,902	NE
Freshwater Withdrawals	6,868	7,949	7,841	9,505	7,519	8,795
Agriculture	6,427	7,639	7,254	8,809	6,706	7,580
Steam-Electric	101	53	157	172	201	248
Manufacturing	4	<1	2	<1	2	<1
Domestic	70	105	76	159	83	201
Commercial	10	NA	10	NA	11	NA
Minerals	132	120	195	304	355	698
Public Lands	103	32	120	61	127	68
Fish Hatcheries	20	NE	27	NE	34	NE
Other	0	NE	0	NE	0	NE
Freshwater Consumption	2,441	2,118	3,017	2,890	3,232	3,419
Agriculture	2,221	1,956	2,688	2,479	2,775	2,668
Steam-Electric	38	50	106	164	151	241
Manufacturing	2	<1	1	<1	2	<1
Domestic	25	39	27	58	29	74
Commercial	3	NA	4	NA	4	NA
Minerals	47	45	72	137	144	376
Public Lands	103	27	120	52	127	60
Fish Hatcheries	0	NE	0	NE	0	NE
Other	0	NE	0	NE	0	NE
Ground Water Withdrawals	126	105	NE	105	NE	105
Reservoir Evaporation	688	662	688	860	688	860
Instream Approximation						
Fish and Wildlife	7,947	NE	7,947	NE	7,947	NE

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

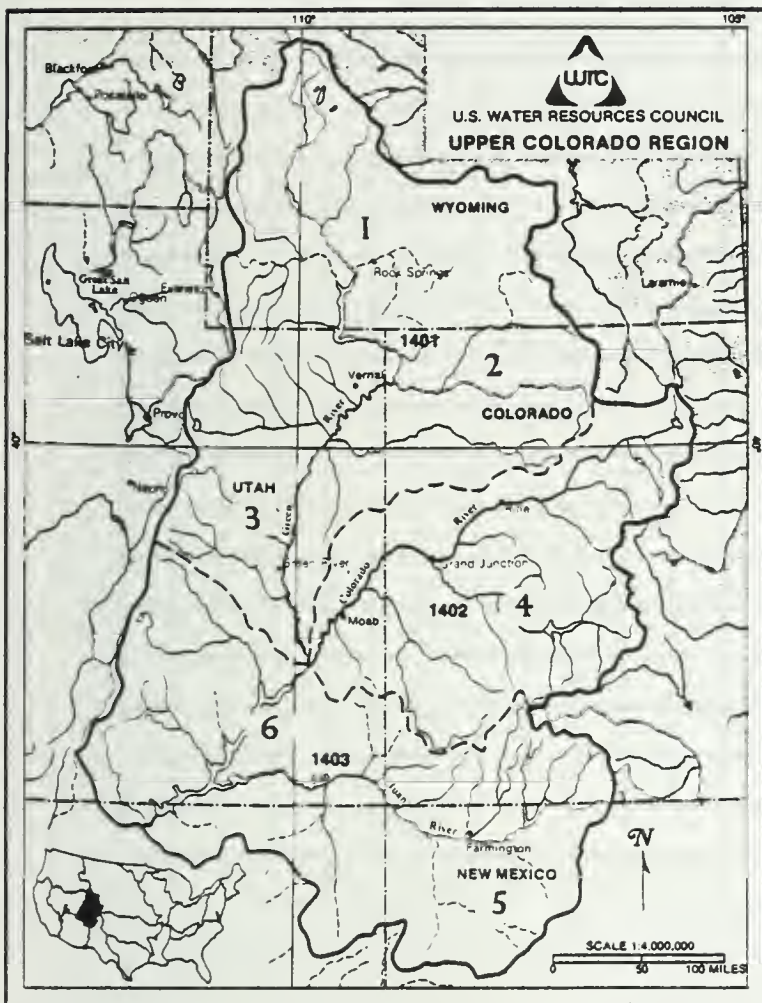
Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



UPPER COLORADO REGION

PROBLEM AREAS

1. Green River - Wyoming
2. Yampa-White River - Colorado, Wyoming
3. Uinta Basin, Price, San Rafael - Utah
4. Colorado, Gunnison, Dolores - Colorado
5. San Juan River - Colorado, New Mexico
6. Canyon Lands - Utah

FIGURE V-4I

Problem Issues	1401	1	2	3	1402	4	1403	5	6
Water Quantity									
Fresh Surface	0	X	X	X	0	X	0	X	X
Ground	0				0		0		
Marine & Estuarine									
Surface/Depth									
Water Quality									
Fresh Surface	0	X	X	X	0	X	0	X	X
Ground	0				0		0		
Marine & Estuarine									
Surface/Depth									
Related Lands									
Flooding	0								
Drainage					0				
Erosion/Sediment	0	X	X	X			0	X	X
Dredge & Fill, Subsidence									
Water Related Use Conflicts	0	X	X	X	0	X	0	X	X
Other		X	X	X		X	0	X	X

O Problem Issues Identified by Federal Agency Representatives

X Problem Issues Identified by State-Regional Representatives

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LOWER COLORADO REGION

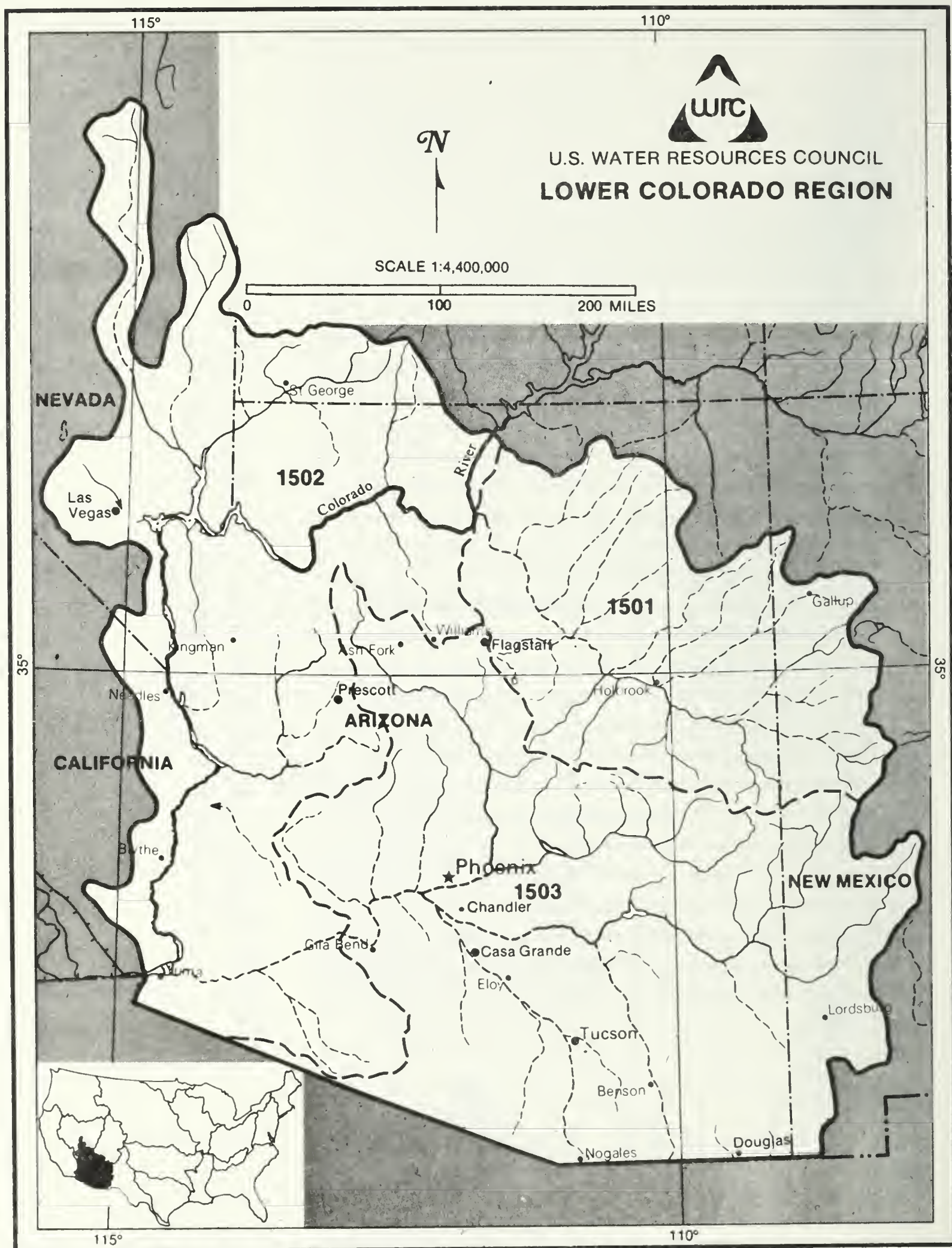


FIGURE V-4 3

THE LOWER COLORADO REGIONHighlights

- The Lower Colorado Region encompasses an area of about 154,848 square miles. It includes several closed basins in Arizona, western New Mexico, southern Nevada, southwestern Utah, and some areas in Arizona and New Mexico that drain into Mexico. Except for a portion in southern California, the Region is hydrologically defined by the drainage area of the Colorado River below Lee Ferry, Arizona. The Lower Colorado Region receives an annual apportionment of Colorado River water as established by various treaties and compacts.
- The Colorado River System is one of the more water deficient river systems in the Nation, while over half the population of the West is dependent on its meager and poorly distributed water supply. Current water uses are exceeding available renewable supplies. The difference is presently being obtained by overdraft of the ground water supply in central Arizona and southern Nevada.
- Water withdrawals are used mainly for irrigation. Almost half of the irrigated acres in the Region are dependent entirely on dwindling ground water supplies.
- The average annual supply of the Colorado River soon will be inadequate to meet treaty and compact requirements. Surface and ground water

supplies are insufficient to meet present uses, and aquifers are being overdrafted. As ground water levels drop, problems of increased pumping costs, land subsidence, and earth fissures become more prevalent. A major water quality concern stems from high levels of dissolved mineral salts. The Lower Colorado also experiences problems of flooding and erosion and sedimentation.

- Twelve geographic problem areas are identified (see Figures V-44 and V-45).
- The Federal role in providing cooperative analysis and aid in the resolution of high priority problems should be continued in the Lower Colorado. Specific conclusions and recommendations are made regarding needed solutions to various regional problems, such as ground water considerations. No Level B studies are identified. Research is needed to develop more complete and accurate modeling of the surface and ground water system. (For more detail see the Lower Colorado Regional Chapter.)

Comparative Analysis

Table V-16 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows and water needs in the Lower Colorado Region.

The total withdrawal requirements of the SRF and NF for 1985 are in close agreement. SRF withdrawal values for the year 2000 are 13 percent higher than the NF values. Even with similar total withdrawal values, significant internal differences exist.

The SRF projections of domestic and manufacturing withdrawal and consumptive water requirements are consistently higher than the NF, reflecting higher populations and a slightly higher per capita consumption.

There are significant differences between the SRF-NF water requirements for the mineral industry. The SRF water requirements resulted from a survey of the mining companies in the course of collecting data for the Arizona State Water Plan. About 97 percent of the water used by the Region's mineral industry occurs in Arizona. The basic difference is the degree of recycling assumed in the two projections. In the Region, water for mining is generally in short supply and costly to obtain. The water is recycled several times during the ore processing before finally being conveyed to lined evaporative disposal ponds. Except for sand and gravel operations, little water is returned to streams or ground water aquifers. It is not acceptable at present nor will it be in the future to return the wastewater from mining activities to streams or ground water aquifers as implied in the NF projections.

The NF consumptive use coefficient is based on optimum crop growth with 50 percent drought probability. The SRF consumptive use coefficient is lower than the NF. The SRF coefficient is based on an average year and somewhat less than optimum crop growth. These differences apply to the withdrawal requirements as well. The SRF assumes a slightly higher irrigation efficiency.

The 1975 SRF water withdrawals and consumptive use figures for steam-electric are smaller by 18 and 16 percent respectively than the NF values. The 1985 SRF withdrawal requirements are 11 percent higher than the NF. The SRF projections contend that nearly all steam-electric plants in the Region will continue to use wet cooling towers and recycle the water. In most of the plants, little, if any, water is returned to the stream system. Water quality standards encourage the continuation of this practice. In the year 2000, the SRF projections of both withdrawal and consumptive use are considerably higher than the NF. The NF assumes that after 1985 new steam-electric plants will use dry cooling towers. The SRF projection does not assume that there will be a significant use of dry cooling towers by this date, because of the loss of efficiency and high cost.

Table V-16

THE LOWER COLORADO REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	2,412	2,683	2,915	3,740	3,629	5,071
Total Employment	940	1,031	1,165	1,491	1,466	2,044
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s)	1,550	1,543	-1,431	NE	-1,541	NE
Freshwater Withdrawals	8,915	7,962	8,527	8,522	7,858	8,882
Agriculture	8,036	6,955	7,351	6,838	6,403	6,635
Steam-Electric	68	56	150	167	154	267
Manufacturing	87	124	90	192	138	247
Domestic ^{1/}	423	580	520	879	658	1,110
Commercial	75	NA	92	NA	114	NA
Minerals	184	156	252	281	311	436
Public Lands	20	23	49	57	56	65
Fish Hatcheries	22	NE	22	NE	23	NE
Other	0	68	0	108	0	122
Freshwater Consumption	4,597	4,891	4,755	5,268	4,708	5,556
Agriculture	4,073	4,229	4,014	4,161	3,780	4,062
Steam-Electric	63	53	134	162	126	250
Manufacturing	54	63	54	94	103	123
Domestic ^{1/}	199	317	245	440	310	544
Commercial	35	NA	43	NA	54	NA
Minerals	151	142	217	262	280	412
Public Lands	19	23	47	56	54	65
Fish Hatcheries	0	NE	0	NE	0	NE
Other	0	64	0	93	0	100
Ground Water Withdrawals	5,008	4,324	NE	2,447	NE	3,609
Reservoir Evaporation	1,153	1,230	1,153	1,232	1,153	1,240
Instream Approximation						
Fish and Wildlife	6,864	0	6,864	0	6,864	0

^{1/} SRF domestic water use includes commercial and institutional requirements.

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

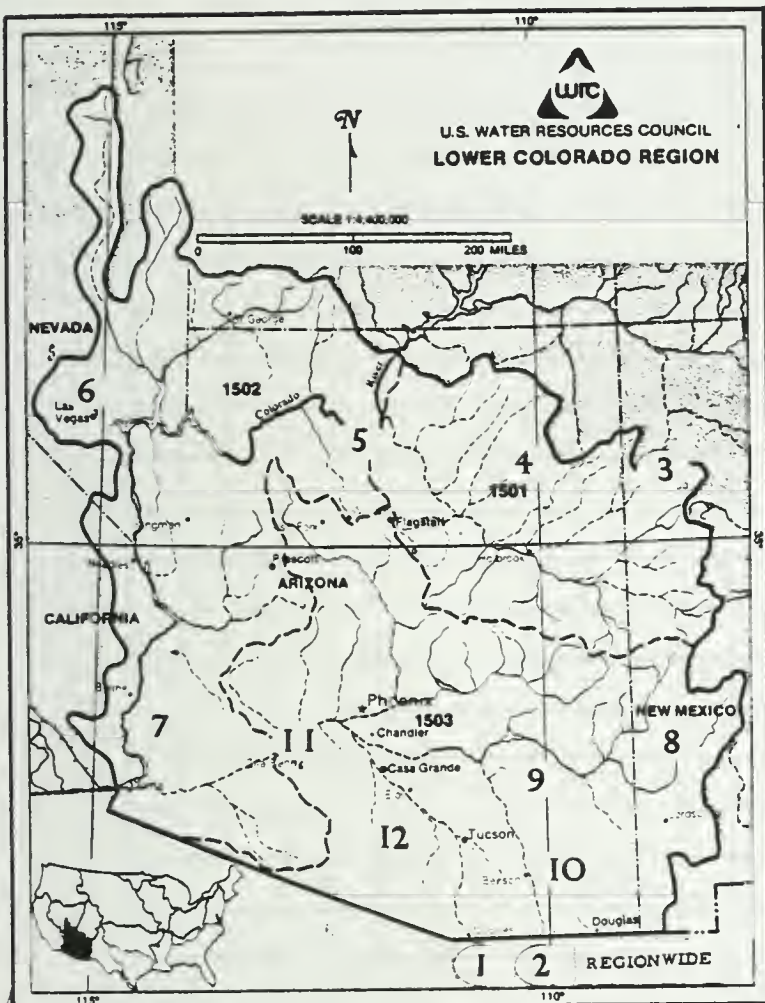
Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



LOWER COLORADO REGION

PROBLEM AREAS

1. Lower Colorado River Water Quantity Deficiencies
2. Lower Colorado River Mainstream Water Quality Deficiencies
3. McKinley County, New Mexico
4. Apache and Navajo Counties, Arizona
5. Coconino County, Arizona
6. Las Vegas Valley, Nevada
7. Lower Colorado River Valley, Arizona and Nevada
8. Catron, Grant, Hidalgo Counties, New Mexico
9. Greenlee and Graham Counties, Arizona
10. Cochise County, Arizona
11. Maricopa County, Arizona
12. Pima-Pinal Counties, Arizona

FIGURE V-44

FIGURE V-45
OCCURRENCE OF PROBLEM ISSUES BY
AGGREGATED SUBREGION AND PROBLEM AREAS —

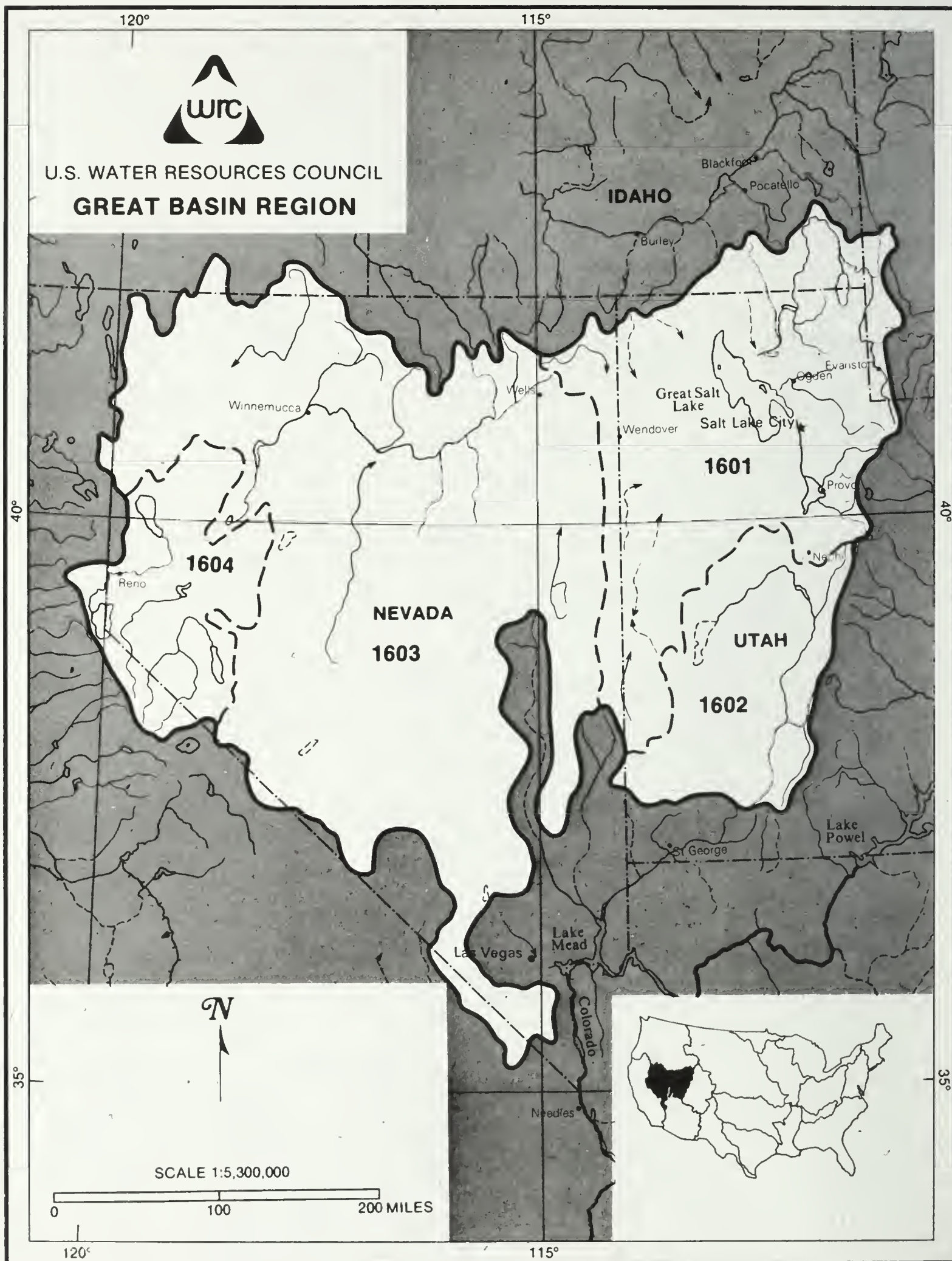
LOWER COLORADO

Problem Issues	1500	1	2	1501	3	4	1502	5	6	7	1503	8	9	10	11	12
Water Quantity																
Fresh Surface		X		O	X	X	O	X	X	X	O	X	X		X	X
Ground				O	X	X	O		X	X	O	X	X		X	X
Marine & Estuarine																
Surface/Depth																
Water Quality																
Fresh Surface			X	O	X	X	O	X	X	X	O	X	X		X	X
Ground					X	X		X	X	X		X	X		X	X
Marine & Estuarine																
Surface/Depth																
Related Lands																
Flooding					X	X		X	X	X	O	X	X		X	X
Drainage									X	X	X					
Erosion/Sediment				O	X	X	O	X		X	O	X	X		X	X
Dredge & Fill, Subsidence							O									
Water Related Use Conflicts	X							X		X		X	X		X	X
Other				O	X	X	O			X	O	X	X		X	X

O Problem Issues Identified by Federal Agency Representatives

X Problem Issues Identified by State-Regional Representatives

GREAT BASIN REGION



THE GREAT BASIN REGIONHighlights

- The Great Basin Region encompasses approximately 139,389 square miles in Utah, Nevada, and Idaho. Most of the streamflow in the Region originates in the high mountains at its eastern and western edges. The Region is part of a hydrologically closed basin, and all of the rivers and streams eventually end in terminal lakes or sinks where evaporation creates high salinities.
- The available water supply in the Region is not sufficient to meet needs in many areas. Streamflows vary seasonally and diminish drastically in late summer; therefore, surface water resources are poorly distributed with respect to time and location. Ground water supports most developments located away from the base of the mountains, but recharge rates are low, and storage depletions occur in central parts of the Region.
- Irrigation is by far the largest use of withdrawals from surface and ground water sources.
- The scarcity of water in the Region generates competition for its use and for land that is well-located with respect to water. In several areas, lack of water is impeding further economic development, and urbanization of agricultural lands is causing conflicts. The Region's ample land resources cannot be used to the fullest extent for agricultural purposes

because water availability is limited. Water quality varies from excellent in mountain headwater streams to poor in lower stream reaches and terminal lakes. Principal pollutants are salts, sediment, nutrients, and heat. Flooding is a serious and widespread problem. Other important water-related issues concern institutional and financial arrangements.

- Ten geographic problem areas are identified (see Figures V-47 and V-48).
- In the Great Basin the Federal government should aid in the solution of water matters only when the States are unable to effect remedies. Ten specific conclusions are listed in the Great Basin Regional Report emphasizing the importance of local entities in water resources management. No additional Level B Studies are needed. (For more details see the Great Basin Regional Report.)

Comparative Analysis

Table V-17 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows and water needs in the Great Basin Region.

The NF estimate for total water withdrawals is 75 percent of the SRF estimate in 1975. The NF projections call for a declining total water withdrawal for 1985 and 2000, whereas SRF projections call for a small increase in total water withdrawals. For the year 2000, the SRF estimates are about 58 percent larger than those of the NF. A portion of the NF

projected decrease in total water withdrawals is due to expected reductions of withdrawals for irrigation by about 16 percent between 1975 and 2000. The comparable data for the SRF calls for only a 2 percent reduction.

Total NF water consumption estimates are consistently less than the SRF estimates for the next 25 years. NF agricultural consumption estimates alone are less than the SRF figures by 16 percent in 1975 and by 21 percent in the year 2000. Estimates for the consumption of water for steam-electric purposes differ even further, as 1975 SRF estimates are double those of NF estimates. However, data for the year 2000 show a complete reversal of anticipated needs as NF estimates for steam-electric purposes is double that of the SRF estimates. Despite their large differences relative to one another, the amount of water involved in this use is small compared to other uses. The most drastic difference in the SRF and NF data concerns ground water withdrawals; whereas NF data estimate 1,424 MGD for 1975, the SRF estimates only 20 MGD.

Table V-17

THE GREAT BASIN REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	1,262	1,374	1,464	1,781	1,739	2,448
Total Employment	517	550	626	756	767	1,058
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow into Closed Basins	10,540	10,540	10,035	NE	9,836	NE
Freshwater Withdrawals	7,989	10,683	7,312	10,813	7,258	11,490
Agriculture	7,002	7,063	6,154	6,946	5,861	6,931
Steam-Electric	33	8	65	12	82	22
Manufacturing	112	89	92	148	98	327
Domestic ^{1/}	340	348	399	452	475	613
Commercial	38	NA	45	NA	55	NA
Minerals	145	187	206	285	273	371
Public Lands	319	363	351	400	411	467
Fish Hatcheries	2	2	3	3	3	3
Other	0	2,623	0	2,567	0	2,756
Freshwater Consumption	3,778	6,805	3,763	7,088	4,034	7,368
Agriculture	3,258	3,857	3,116	4,029	3,232	4,087
Steam-Electric	3	6	42	10	52	20
Manufacturing	24	25	42	51	76	135
Domestic ^{1/}	131	155	151	202	179	273
Commercial	17	NA	19	NA	22	NA
Minerals	28	61	44	105	64	99
Public Lands	319	361	351	398	411	464
Fish Hatcheries	0	0	0	0	0	0
Other	0	2,340	0	2,293	0	2,290
Ground Water Withdrawals	1,424	20	NE	24	NE	28
Reservoir Evaporation	317	2,469	317	2,411	317	2,336
Instream Approximation						
Fish and Wildlife	8,177	0	8,177	0	8,177	0

^{1/} SRF domestic water use includes commercial and institutional requirements.

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

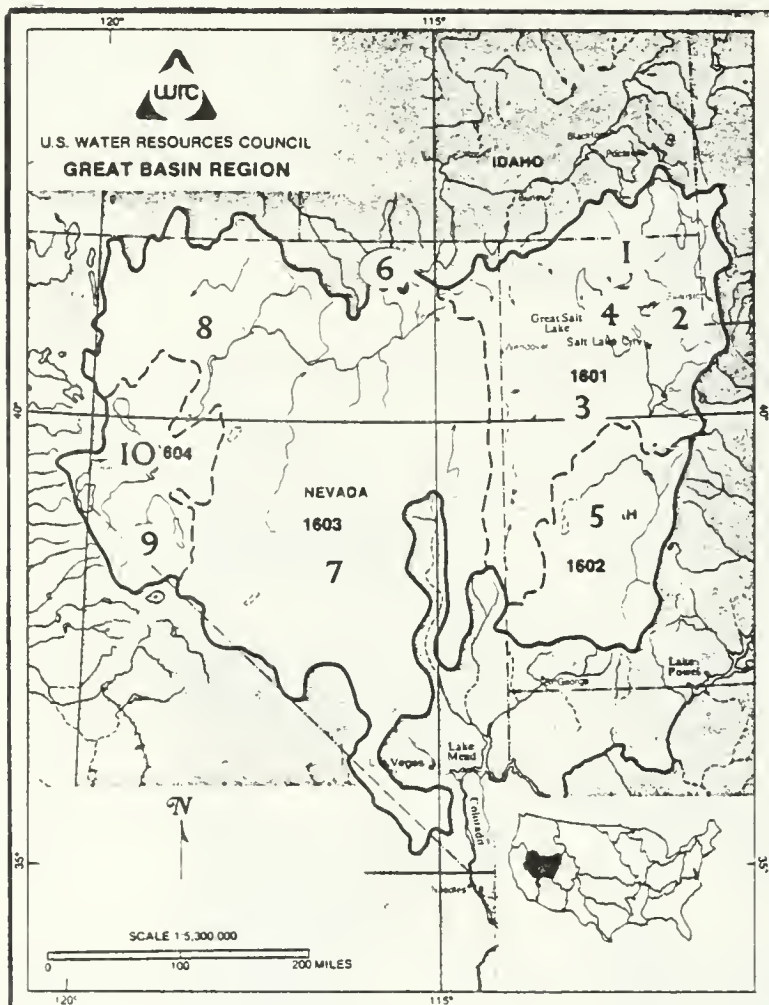
Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



GREAT BASIN REGION

PROBLEM AREAS

1. Bear River area
2. Weber-Davis area
3. Jordan River area
4. Great Salt Lake area
5. Sevier-Beaver area
6. Snake River Basin area
7. Central Region area
8. Humboldt River Basin area
9. Walker River Basin area
10. Carson-Truckee River Basins area

FIGURE V-47

O Problem Issues Identified by Federal Agency Representatives
X Problem Issues Identified by State-Regional Representatives

PACIFIC NORTHWEST REGION

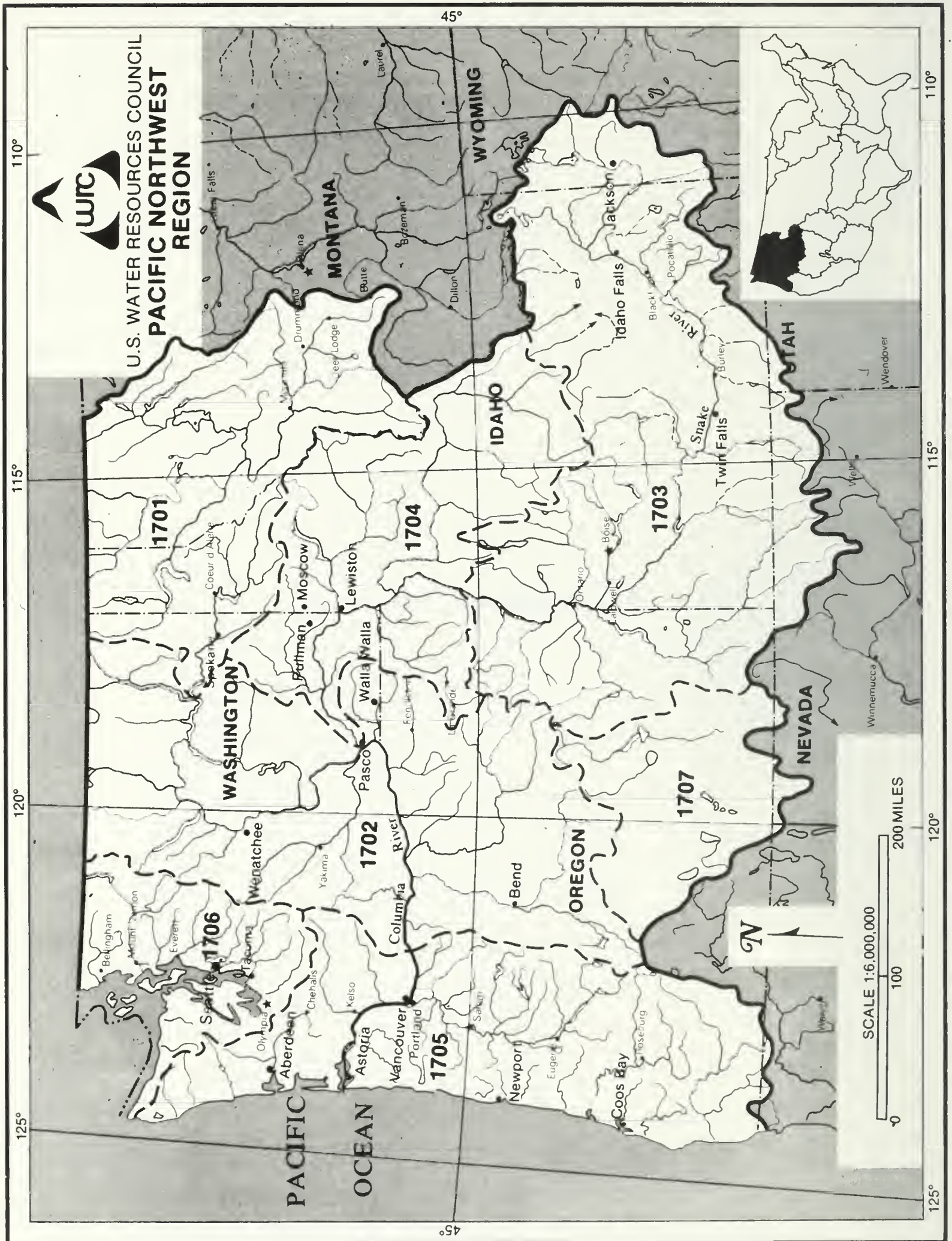


FIGURE V- 49

THE PACIFIC NORTHWEST REGIONHighlights

- The Pacific Northwest Region occupies 110,919 square miles in the northwestern portion of the United States.
- The Region as a whole has an abundant supply of water on an average annual basis. The supply, however, is not equally distributed throughout the year or throughout the Region. In some areas, the maldistribution of surface supplies is compensated for by the presence of ground water supplies. In many areas, however, particularly east of the Cascade Range, the lack of surface and ground water supplies causes seasonal shortages of water, particularly for use in irrigation, resulting in conflicts between competing instream and offstream uses.
- Irrigation is the principal offstream use of water withdrawals while fish life, recreation, hydroelectric power, and navigation are the principal instream uses.
- During the summer, conflicts exist between the need for irrigation and the need for sufficient streamflows to maintain high water quality for the salmon fishery. Additional reservoirs can only be constructed in areas of prime wildlife habitat or of high scenic value. Many water quality problems have been remedied already; major remaining difficulties are associated with enrichment of streamflow, sedimentation, and estuarine

pollution. Major land use conflicts occur between development and conservation uses. The legal status of water flowing through Federal reserved lands and Indian reservations is unclear.

- Four geographic problem areas are identified (see Figures V-50 and V-51).
- In the Pacific Northwest, it is recommended that the Federal government, while continuing to discharge its statutory responsibilities, concede leadership in water resource matters to the states of the Pacific Northwest River Basins Commission, with the Commission, as necessary, coordinating the efforts of the Federal and state agencies. Because current studies are addressing the problem areas identified, no new Level B Studies are proposed. Data collection and research should be expanded in the Oregon Coastal Area, the Puget Sound Area, the Snake River, and the Columbia River. New institutional arrangements are needed to improve cooperation among various governmental levels dealing with water issues. (For more details see the Pacific Northwest Regional Report.)

Comparative Analysis

Table V-18 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows and water needs in the Pacific Northwest Region. For the Pacific Northwest Region only limited SRF data is available on a basis comparable to NF data, and therefore no real comparison between the two is possible.

Table V-18

THE PACIFIC NORTHWEST REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	6,703	6,783	6,991	8,089	7,589	9,780
Total Employment	2,642	2,440	2,958	2,931	3,345	3,607
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s) /into Closed Basins	225,270	239,570	251,892	NE	251,288	NE
Freshwater Withdrawals	37,493	37,493	38,100	NE	33,843	NE
Agriculture	33,253	33,253	34,725	NE	30,063	NE
Steam-Electric	260	260	203	NE	580	NE
Manufacturing	2,324	2,324	1,320	NE	1,130	NE
Domestic	804	804	863	NE	957	NE
Commercial	274	274	282	NE	307	NE
Minerals	118	118	141	NE	167	NE
Public Lands	190	190	262	NE	332	NE
Fish Hatcheries	272	272	301	NE	314	NE
Other	0	0	0	NE	0	NE
Freshwater Consumption	11,905	11,905	14,615	NE	15,193	NE
Agriculture	11,098	11,098	13,448	NE	13,315	NE
Steam-Electric	13	13	104	NE	344	NE
Manufacturing	325	325	501	NE	880	NE
Domestic	210	210	220	NE	238	NE
Commercial	55	55	56	NE	60	NE
Minerals	18	18	19	NE	27	NE
Public Lands	190	190	262	NE	332	NE
Fish Hatcheries	0	0	0	NE	0	NE
Other	0	0	0	NE	0	NE
Ground Water Withdrawals	7,348	7,348	NE	NE	NE	NE
Reservoir Evaporation	1,915	1,915	1,915	1,915	1,915	1,915
Instream Approximation						
Fish and Wildlife	214,004	214,004	214,004	214,004	214,004	214,004

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

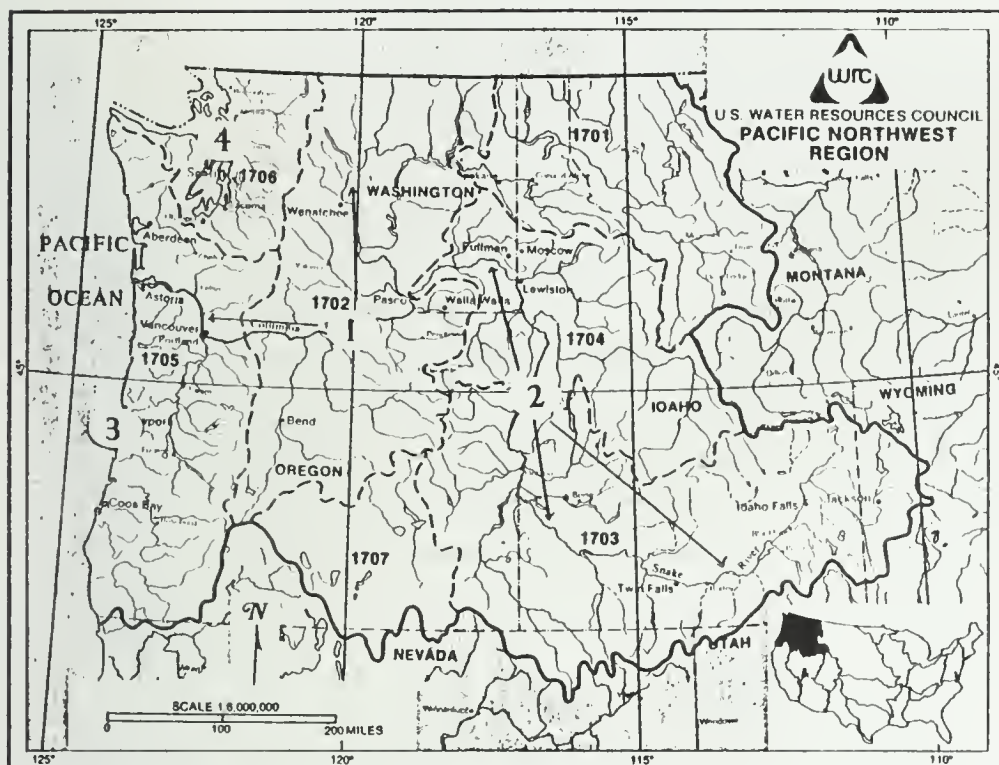
Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



PACIFIC NORTHWEST REGION

PROBLEM AREAS

1. Columbia River
2. Snake River
3. Oregon Coast
4. Puget Sound

FIGURE V- 50

O Problem Issues Identified by Federal Agency Representatives
X Problem Issues Identified by State-Regional Representatives

* Problem Area 2 occurs in ASRs 1703 and 1704.

CALIFORNIA REGION



FIGURE V-52

THE CALIFORNIA REGIONHighlights

- The California Region includes about 164,892 square miles with 1,050 miles of coastline. It includes the State of California and Klamath County, Oregon.
- Water supplies are poorly distributed in place and time with respect to need. Areas of water surpluses are in the northern part of the Region, while areas of primary water demand are in the central and southern portions. Similarly, the largest irrigation demand occurs in late summer, while peak supply occurs in the winter. Reservoir storage and extensive conveyance facilities have been developed to permit effective use of surface water. Ground water has also been widely developed.
- Freshwater withdrawals go mainly to irrigation.
- One of the Region's major concerns is the discrepant distribution of water supplies. The quality of most of the water in the Region is superior to the average quality of waters in the Nation, but ranges from extremely high in alpine lakes to low along the southern coast and in the lower parts of closed basins. Erosion and sedimentation, flooding, shortages of ground water, and needs for recreational water surface area and drainage are problems faced by various subareas in the Region. Other major issues in the Region include allocation of limited inland waters for power plant cooling, water rights, waste water reclamation and environmental protection.

- Three geographic problem areas are identified (see Figures V-53 and V-54).
- Recommendations on the Federal role, planning, data and research, and institutional matters focus on specific activities, such as legislation, funding, and studies, that the Congress and Federal agencies should emphasize. (For more details see the California Regional Report).

Comparative Analysis

Table V-19 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows and water needs in the California Region.

The NF estimates for total freshwater withdrawals are 3 percent over the SRF estimates for 1975. Both the NF and SRF projections call for an increase in freshwater withdrawals. For the year 2000, the SRF estimate is about 10 percent larger than that of the NF. Between 1975 and 2000, NF withdrawals for agriculture are expected to remain about the same. The comparable data for the SRF calls for a 14 percent increase.

A different situation exists with respect to consumption. For 1975, the NF estimate exceeds that of SRF by 24 percent and for the year 2000, by 15 percent. Agriculture consumption estimates follow the trend set by total consumption. NF projections exceed SRF data by 31 percent in 1975 and by 22 percent in the year 2000. Both views of domestic, commercial and institutional consumption foresee increases. However, SRF estimates are larger than those of the NF by 17 percent in 1975 and 32 percent in the year 2000.

Table V-19

THE CALIFORNIA REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	21,160	21,168	23,703	24,422	27,093	29,344
Total Employment	8,828	8,894	10,226	10,604	12,080	13,093
VOLUMETRIC DATA (mgd) -Mean Annual Conditions-						
Streamflow at Outflow Point(s) /into Closed Basins	48,246	47,320	44,381	NE	42,415	NE
Freshwater Withdrawals	39,635	38,351	40,542	41,792	41,259	45,468
Agriculture	34,709	29,955	34,981	32,290	34,900	34,282
Steam-Electric	42	2,492	158	2,581	367	2,732
Manufacturing	796	859	829	897	828	890
Domestic <u>1/</u>	3,014	3,986	3,395	4,885	3,890	6,383
Commercial	374	NA	414	NA	470	NA
Minerals	297	NE	359	NE	375	NE
Public Lands	363	NE	371	NE	394	NE
Fish Hatcheries	41	NE	41	NE	41	NE
Other <u>2/</u>	0	1,059	0	1,139	0	1,181
Freshwater Consumption	26,637	21,544	27,929	23,629	29,599	25,849
Agriculture	24,380	18,675	25,252	20,223	26,447	21,638
Steam-Electric	25	48	101	147	242	302
Manufacturing	257	206	370	296	567	446
Domestic <u>1/</u>	1,279	1,673	1,436	1,955	1,641	2,421
Commercial	155	NA	174	NA	198	NA
Minerals	183	NE	225	NE	213	NE
Public Lands	362	NE	369	NE	391	NE
Fish Hatcheries	0	NE	0	NE	0	NE
Other <u>2/</u>	0	942	0	1,008	0	1,042
Ground Water Withdrawals	19,160	12,510	NE	NE	NE	NE
Reservoir Evaporation	646	1,122	646	1,186	646	1,186
Instream Approximation Fish and Wildlife	33,130	33,130	33,130	33,130	33,130	33,130

1/ SRF domestic water use includes commercial and institutional requirements.

2/ SRF other water use includes recreation and wildlife.

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

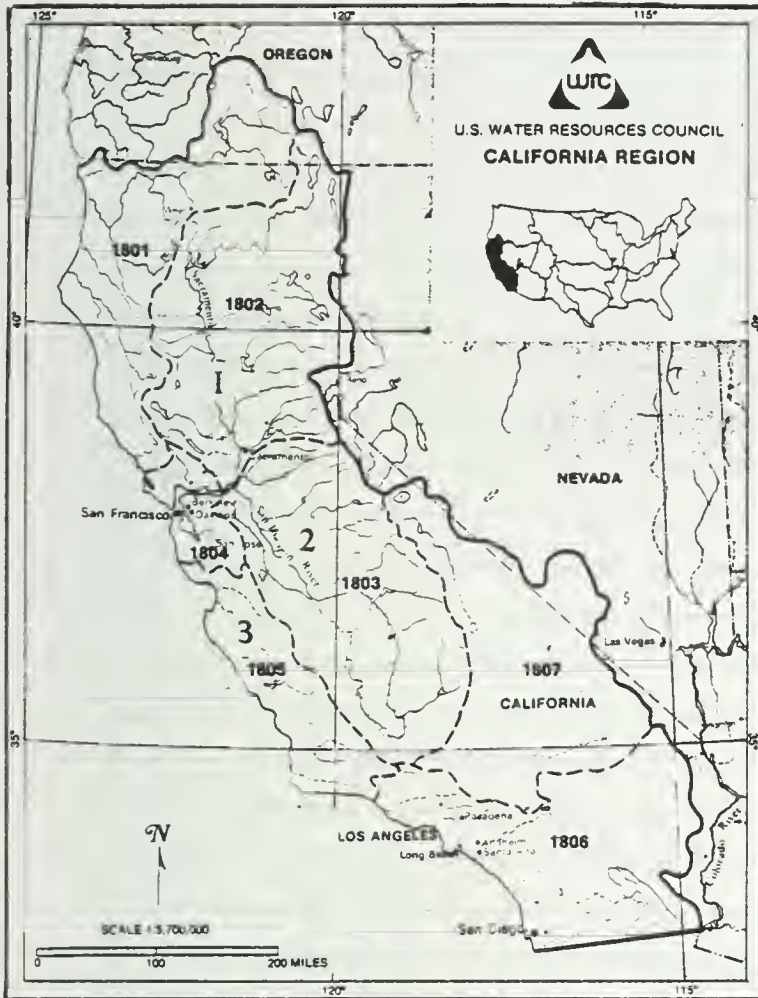
Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



CALIFORNIA REGION

PROBLEM AREAS

1. Sacramento Valley
2. San Joaquin Valley
3. Salinas, Pajaro and Carmel Valleys

FIGURE V-53

Problem issues	1801	1802	1	1803	2	1804	1805	3	1806	1807
Water Quantity										
Fresh Surface	○	○	X	○	X	○	○		○	○
Ground		○		○	X	○	○	X	○	○
Marine & Estuarine										
Surface/Depth		X								
Water Quality										
Fresh Surface	○	○			X	○			○	○
Ground		○		○	X	○	○	X	○	
Marine & Estuarine						○			○	
Surface/Depth										
Related Lands										
Flooding	○	○	X	○	X	○	○	X	○	
Drainage	○	○	X	○	X					
Erosion/Sediment	○		X	○			○		○	○
Dredge & Fill. Subsidence		○			X	○	○		○	
Water Related Use Conflicts			X		X					
Other			X	X	X			X		

O	Problem Issues Identified by Federal Agency Representatives
X	Problem Issues Identified by State-Regional Representatives

ALASKA REGION

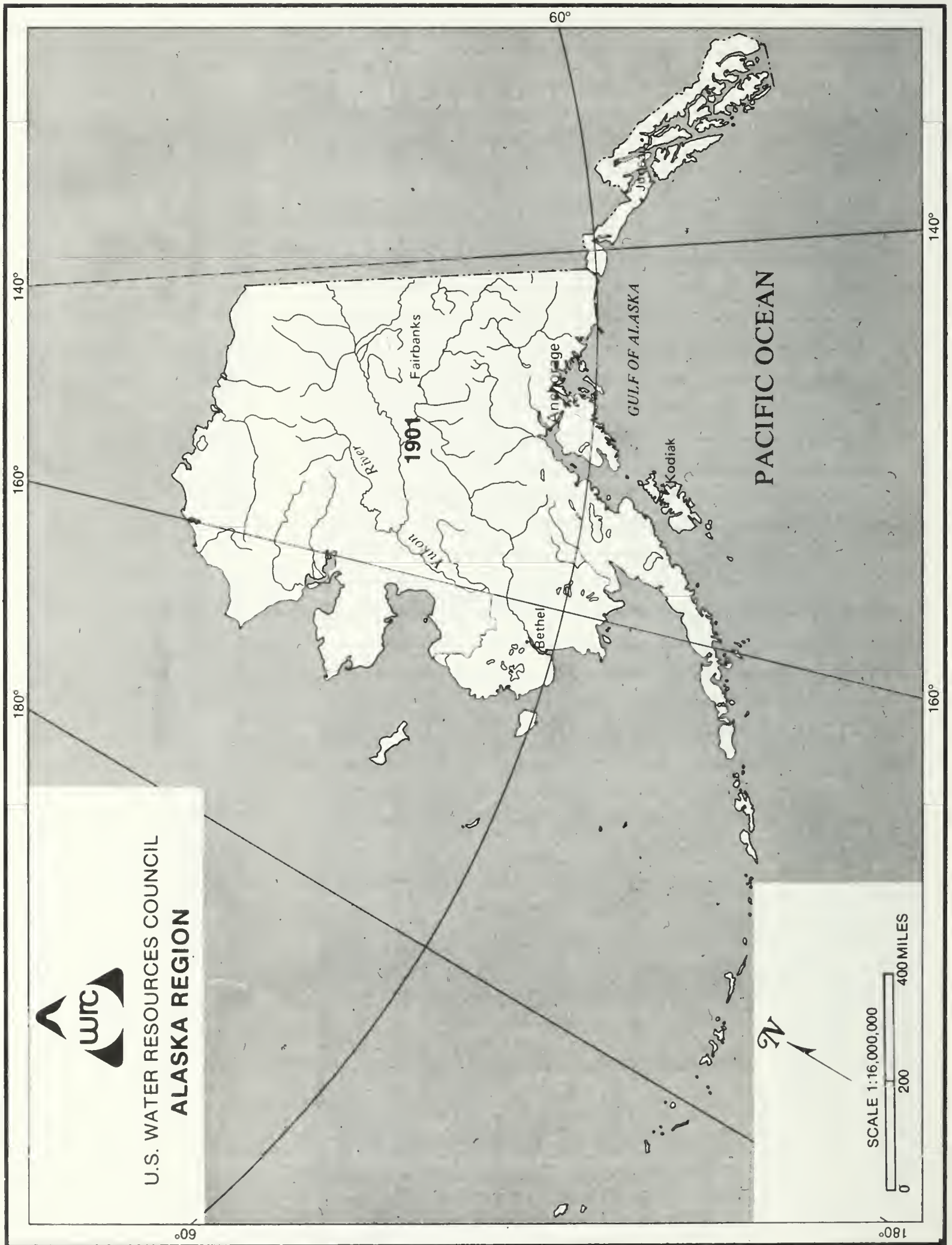


FIGURE V-55

THE ALASKA REGIONHighlights

- The Alaska Region accounts for 1/6 of the area of the United States or about 586,600 square miles. All major streams in the Region originate in Alaska except for the Yukon and Porcupine Rivers and the Alsek, Taku, and Stikine whose headwaters are in Canada. All of the streams in the region flow into either the Arctic Ocean, the Bering Sea, or the Pacific Ocean.
- Alaska has extensive water resources estimated to be roughly one-third of the Nation's freshwater supply. It is evident that, on a Statewide basis, supplies of water substantially exceed demands and will continue to do so for the foreseeable future. However, due to Alaska's unique combination of geology and climate, these water resources are not always readily available.
- Manufacturing accounts for the largest use of water withdrawals. Coal mines, refineries, and petrochemical plants involve significant water requirements.
- One of the major concerns facing the Region is the lack of safe water sources for remote villages. Another is the need for legislation to clarify the allocation of water for instream uses which often are overlooked in the competition for water supply. Recently, energy development

has caused major impacts on land and water resources in Alaska, and the potential for environmental disruptions due to oil, gas, and coal development is tremendous. In many areas where semiarid conditions or extended cold periods exist, water shortages occur frequently and may limit the energy development possible in these locations. Flooding is experienced in numerous places in Alaska. Harbors, maintenance facilities, and well-marked channels are needed for Alaska's commercial and recreational boating activities. There are potentially serious water conflicts between forestry and fishery interests.

- Sixteen geographic problem areas are identified (see Figures V-56 and V-57).
- Conclusions and recommendations are made regarding remote village water supplies, instream water, energy, water availability, flooding, and navigation and ports in terms of federal-state-local roles, planning, data and research, and institutional arrangements. A program such as the Water Resources Council's comprehensive coordinated joint planning program should be established in Alaska. No new Level B studies are proposed. However, data and planning efforts should give priority to needs for water development for municipal and industrial water supplies, port development, hydroelectric power, and enhancement of natural flow for fish and wildlife. (For more details see the Alaska Regional Report.)

Comparative Analysis

Table V-20 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows and water needs in the Alaska Region.

SRF estimates of total withdrawals are greater than the corresponding NF estimates for 1975, 1985, and 2000. No information about fish hatchery water withdrawals is available on the national level. On the other hand, state sources indicate fish hatchery withdrawals that are comparable to those of domestic plus commercial use. If these significant fish hatchery withdrawals are excluded from the SRF total withdrawal figures, the SRF and NF totals become less discrepant. By the year 2000, remaining differences are accounted for largely by the SRF projected increases in agriculture, steam-electric, and manufacturing water use. NF data indicate a decrease or no change in these functional use categories between 1975 and 2000.

Because no estimates of water consumption were developed by the SRF, no meaningful comparisons between SRF and NF consumptive use can be made.

Table V-20

THE ALASKA REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	307	409	361	606	438	992
Total Employment	135	186	164	267	205	426
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s)	905,000	816,000	904,852	NE	904,601	NE
Freshwater Withdrawals	295	345	430	711	756	1,243
Agriculture	4	5	4	76	5	304
Steam-Electric	26	34	17	41	22	81
Manufacturing	133	88	93	125	86	149
Domestic ^{1/}	84	72	105	107	137	177
Commercial	7	NA	9	NA	10	NA
Minerals	30	61	192	230	476	361
Public Lands	10	NE	10	NE	20	NE
Fish Hatcheries ^{2/}	0	85	0	132	0	171
Other	0	0	0	0	0	0
Freshwater Consumption	58	NE	206	NE	457	NE
Agriculture	3	NE	3	NE	4	NE
Steam-Electric	0	NE	2	NE	5	NE
Manufacturing	25	NE	41	NE	67	NE
Domestic	6	NE	8	NE	10	NE
Commercial	1	NE	2	NE	2	NE
Minerals	12	NE	141	NE	350	NE
Public Lands	10	NE	10	NE	20	NE
Fish Hatcheries	0	NE	0	NE	0	NE
Other	0	NE	0	NE	0	NE
Ground Water Withdrawals	44	NE	NE	NE	NE	NE
Reservoir Evaporation	0	NE	0	NE	0	NE
Instream Approximation						
Fish and Wildlife	859,000	NE	859,000	NE	859,000	NE

^{1/} SRF domestic water use includes commercial and institutional requirements.

^{2/} SRF estimates based on average maximum water requirements (10 cubic feet or 6.5 MM gal/day).

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

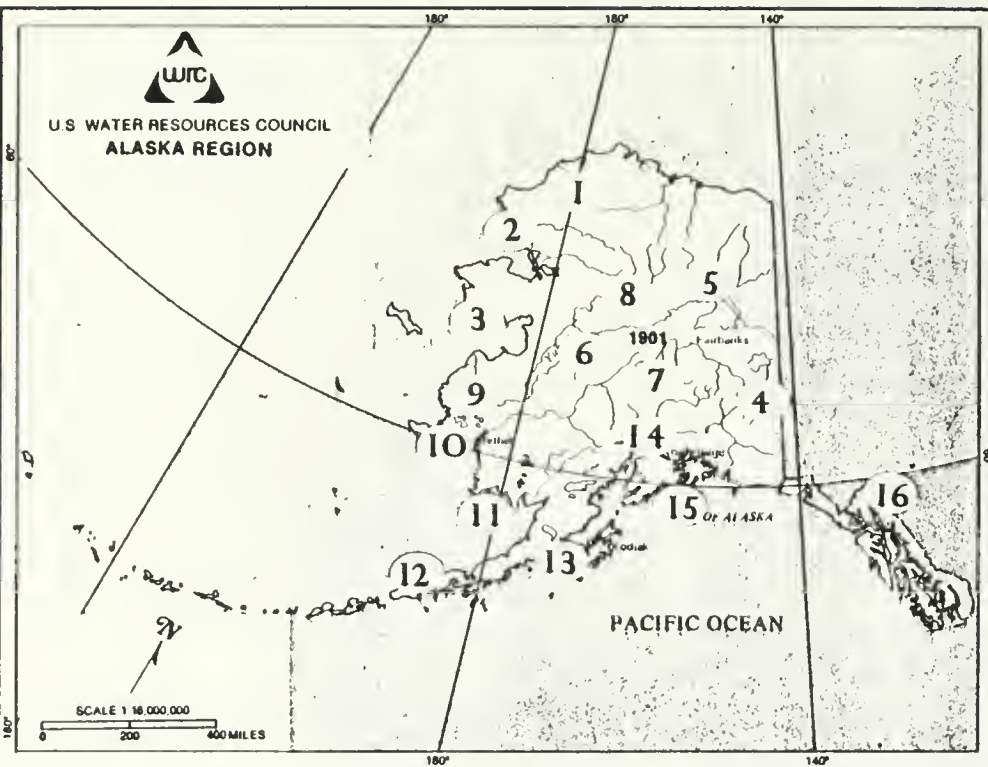
Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



ALASKA REGION

PROBLEM AREAS

- | | |
|-------------------------|---------------------|
| 1. Arctic | 9. Lower Yukon |
| 2. Kotzebue Sound | 10. Kuskokwim Bay |
| 3. Norton Sound | 11. Bristol Bay |
| 4. Upper Yukon - Canada | 12. Aleutian |
| 5. Upper Yukon | 13. Kodiak-Shelikof |
| 6. Central Yukon | 14. Cook Inlet |
| 7. Tanana | 15. Gulf of Alaska |
| 8. Koyukuk | 16. Southeast |

FIGURE V-56

Problem issues	1901	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Water Quantity																	
Fresh Surface	0	X	X	X		X	X	X	X	X	X	X		X	X	X	X
Ground	0		X	X	X	X	X	X	X	X	X	X		X	X		
Marine & Estuarine		X										X					
Surface/Depth	X											X				X	
Water Quality																	
Fresh Surface	0	X	X	X		X	X	X	X	X	X	X		X	X	X	X
Ground	0	X	X	X		X	X	X	X	X	X	X		X		X	
Marine & Estuarine		X	X	X						X	X	X		X	X	X	X
Surface/Depth																	
Related Lands																	
Flooding	0	X	X	X		X	X	X		X	X			X	X	X	X
Drainage															X		X
Erosion/Sediment		X	X	X	X	X	X	X	X	X				X	X	X	X
Dredge & Fill. Subsidence								X			X			X	X	X	
Water Related Use Conflicts		X		X	X	X	X	X	X			X		X	X	X	X
Other	0	X			X	X	X	X		X	X			X	X	X	X

O Problem Issues Identified by Federal Agency Representatives
X Problem Issues Identified by State-Regional Representatives

HAWAII REGION

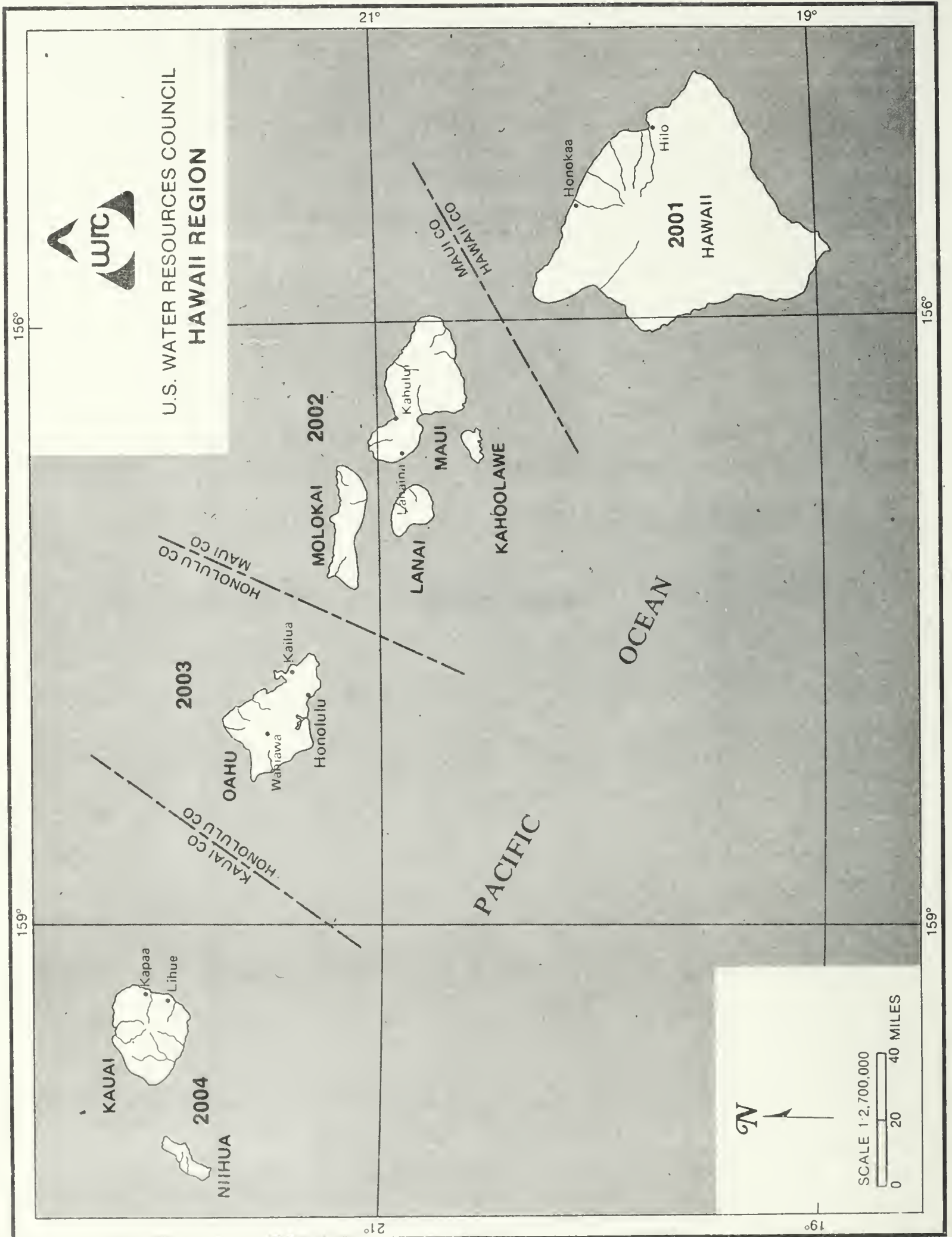


FIGURE V-58

THE HAWAII REGIONHighlights

- The Hawaiian Archipelago contains 132 islands, shoals, and reefs which contain about 6,450 square miles within the State of Hawaii.
- Rainfall in Hawaii is ample to supply the present and foreseeable future water requirements of all the major islands. Any supply problems are due to inequalities in the distribution of rainfall rather than to insufficient quantities. Surface water diverted from streams represents the major source of water; streams are perennial and abundant where rainfall is plentiful and well-distributed through the year and where the ground is not extremely porous. Ground water occurs as basal water, as dike impounded water, and as perched water; pumping from these supplies is currently within safe limits. Hawaii's unique combination of geology and rainfall makes it difficult to apply normal water-soil relationships.
- Irrigation is the largest user of water withdrawals.
- Except for the island of Oahu, all the islands have sufficient water supplies to meet demands until the year 2000. Many water systems, however, rely on surface water supplies which sometimes have undesirable taste, odor, and turbidity, and other water systems obtain supplies from aquifers that are in potential danger of contamination. Flood damages in Hawaii

have been extensive, making flood forecasting an important endeavor. Degradation of environmental quality due to siltation, sewage, chemical and thermal pollution, and conflicting land use and the resultant threat to endangered species are major concerns. With increasing demands for water, the question over whether to develop or to preserve freshwater habitat becomes more pressing.

- Four water-related problems are identified in the Hawaii Regional Report (see Figure V-59).
- No geographical problem areas are identified by the Hawaii Region. The federal viewpoint concerning the occurrence of problems by ASR is shown in Figure V-60.
- Conclusions and recommendations for the Hawaii Region are made regarding water supply, water quality, floods, environmental degradation, and endangered species. No new Level B Studies are recommended (a Level B Study for Hawaii was completed in 1977). Most water-related problems and opportunities are being addressed already by ongoing programs, e.g., the coastal zone management plan, the area-wide waste treatment plan, and on-going urban studies. Gaps in Hawaii's data program include the lack of raw data and the lack of adequate data storage, retrieval, dissemination and analysis capabilities; these gaps are particularly significant in the environmental and land and water use data areas.

Comparative Analysis

Table V-21 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows and water needs in the Hawaii Region.

The State-Regional Future was extracted from the Hawaii Water Resources Regional Plan and because the plan did not include 1985 as a time period, totals were not available for this year. The plan projected figures for the year 2000; these comparisons can be made with the National Future.

One of the main differences between the NF and the SRF is the determination of population growth. NF projections show lower growth for the Region than the SRF (38%), while the study team for the economic analysis of the regional plan, which consisted of State and County planners, predicts population to increase by 57% between 1975 and 2000.

What is not shown in the tables is the effect of the visitor industry. In 1975 there was an average of 60,000 visitors per day in the Region. In the year 2000 it is estimated that this total will be substantially increased. The effects of the visitor industry is demonstrated in the volumetric requirements for domestic water and this accounts for the great differences in the total withdrawals.

One of the major goals of the Region is to encourage more agricultural development. This is reflected in the difference between the NF and SRF irrigation withdrawals projected for the year 2000.

Table V-21

THE HAWAII REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	787	865	911	1,058	1,085	1,355
Total Employment	365	347	431	451	519	599
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s)	6,747	NE	6,713	NE	6,685	NE
Freshwater Withdrawals	1,879	1,516	1,619	NE	1,350	2,129
Agriculture	1,449	948	1,229	NE	954	1,354
Steam-Electric	0	0	0	NE	0	0
Manufacturing	251	321	181	NE	139	241
Domestic ^{1/}	148	226	173	NE	210	436
Commercial	29	NA	36	NE	46	NA
Minerals	1	1	1	NE	1	NE
Public Lands	0	0	0	NE	0	0
Fish Hatcheries	0	0	0	NE	0	0
Other	0	20	0	59	0	98
Freshwater Consumption	603	429	637	438	665	439
Agriculture	476	418	484	426	476	424
Steam-Electric	0	0	0	0	0	0
Manufacturing	74	0	88	0	112	0
Domestic	44	0	52	0	63	0
Commercial	11	11	12	12	15	15
Minerals	0	0	0	0	0	0
Public Lands	0	0	0	0	0	0
Fish Hatcheries	0	0	0	0	0	0
Other	0	0	0	0	0	0
Ground Water Withdrawals	852	882	NE	NE	NE	NE
Reservoir Evaporation	1	NE	1	NE	1	NE
Instream Approximation						
Fish and Wildlife	4,590	NE	4,590	NE	4,590	NE

^{1/} SRF domestic water use includes commercial and institutional requirements.

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

The sum of withdrawals and consumption for the nine functional uses does not always equal the total displayed in the summary table due to rounding discrepancies.

SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

NF - National Future, the data estimates developed by Federal agencies to describe 1975 and most probable future conditions.

NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.

Figure V-59

THE HAWAII REGION
Water-Related Problems

<u>Problem</u>	<u>Occurrence</u>	<u>Agency Addressing Problem</u>	<u>Authority</u>
1. <u>Water Supply</u> If Present trends continue the total estimated traditional supply sources can only support an increase in demand through the end of this century (2000).	City & County of Honolulu, Oahu	BWS (City & County of Honolulu) DLNR	County Ordinance Hawaii Revised Statutes (HRS), Chapter 176 - Water Resources
2. <u>Water Quality</u> There is a need for a water policy which contains both quantity and quality requirements.	Regionwide	DPED	HRS Chapter 201 - Department of Planning & Economic Development
Financing of monitoring, laboratories and treatment facilities in order to meet the drinking water quality standards.	Regionwide	EPA DOH BWS/DWS (all counties)	Public Law (PL) 93-523, Safe Drinking Water Act Act 10, Session Laws of Hawaii 1977 County Budgets
3. <u>Floods</u> Damages continue to occur from stream, storm wave and tsunami flooding due to unwise use of Hawaii's flood plains and coastal zone. Completion of flood plain mapping and county implementation of zoning, construction and building ordinances to regulate uses in the flood plain is recommended.	Regionwide	HUD CE DPED DLNR DPW (all counties)	PL 93-234, Flood Disaster Protection Act of 1973 PL 86-645, Flood Control Act of 1960 HRS, Chapter 205A, Coastal Zone Management HRS, Chapter 179, Flood Control and Flood Water Conservation County Zoning, Building and Grading Ordinances
Improvement in the forecasting of severe weather and earthquakes is necessary to allow adequate time to evacuate people in flood plains.	Regionwide	NOAA	15 U.S. Code 311 and 313 Weather Forecasts and Warnings
4. <u>Environmental Quality</u> Degradation of marine, estuarine and fresh water habitat of the State. Degradation includes siltation, sewage, chemical and thermal pollution, and conflicting land and uses.	Regionwide	EPA NOAA DOH SCS SWCD DPED DLNR DPW	PL 92-500, Federal Water Pollution Control Act Amendments PL 92-583, Coastal Zone Management Act of 1972 HRS, Chapter 342 Environmental Quality; Public Health Regulations (PHR); Chapter 37, Water Pollution Control; Chapter 37A, Water Quality Standards; Chapter 37B, Conservation Standards PL 83-566, Watershed Protection and Flood Prevention Act HRS, Chapter 180, Soil & Water Conservation Districts HRS, Chapter 205A, Coastal Zone Management HRS, Chapter 205, Land Use Commission; HRS, Chapter 183, Forest Reservations Water Development, Zoning; DLNR Regulation 4, Land Use Regulations within Conservation Districts County Ordinances

HAWAII

Problem Issues	2001	2002	2003	2004
Water Quantity				
Fresh Surface	○	○	○	○
Ground				
Marine & Estuarine				
Surface/Depth				
Water Quality				
Fresh Surface	○	○	○	○
Ground		○	○	
Marine & Estuarine	○	○	○	○
Surface/Depth				
Related Lands				
Flooding	○	○	○	○
Drainage				
Erosion/Sediment	○	○	○	○
Dredge & Fill, Subsidence				
Water Related Use Conflicts	○	○	○	○
Other	○	○	○	○

O Problem Issues Identified by Federal Agency Representatives

X Problem Issues Identified by State-Regional Representatives

* The Hawaii Region did not identify any geographic problem areas.

CARIBBEAN REGION

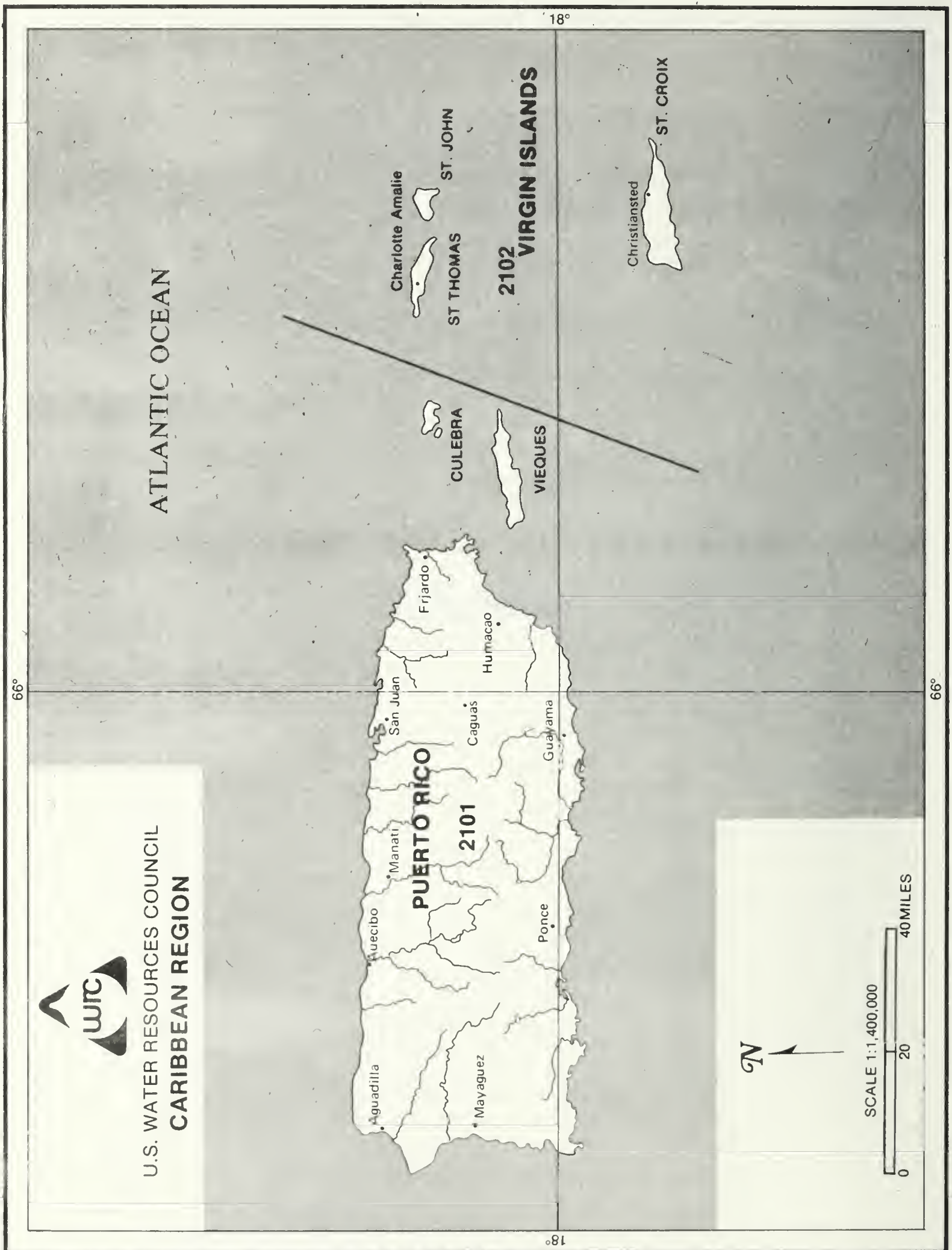


FIGURE V-61

THE CARIBBEAN REGIONHighlights

- Puerto Rico is the largest of the two ASRs of the Caribbean Region and has a territory of about 3,435 square miles. The U.S. Virgin Islands consist of an area of about 132 square miles. Most of the rivers in Puerto Rico are short in length, and none are very large in terms of size or flow. The largest river, the Rio Grande de Loiza, has a drainage area of only 310 square miles. Streamflow in the Virgin Islands is ephemeral, and stream channels respond quickly to rainfall due to the extremely steep topography and tiny watershed areas.
- Because of the lack of island-wide distribution systems in Puerto Rico, water supplies which are ample overall cannot fulfill the needs of heavy demand areas. If managed wisely, Puerto Rico's water resources are sufficient to support significantly increased levels of population and economic activity. The Virgin Islands, however, have very limited water supplies. Water sources include raw and desalinated sea water, rainwater collection, wastewater recycling, and barging. The distribution facilities are very poor in this ASR, and the desalination plants break down often.
- Irrigation accounts for the largest use of water withdrawals.
- In Puerto Rico, institutional problems are the most severe impediment to resolution of water and related land resource issues. Water quality is

another major concern in this ASR as surface waters are used as waste depositories and for domestic and agricultural needs. Flooding and erosion and sedimentation are experienced in both ASRs. In the Virgin Islands, the most crucial water resource problems are related to the poor condition of the water supply and distribution system.

- Eleven geographic problem areas, seven in Puerto Rico and four in the Virgin Islands, have been identified (see Figures V-62 and V-63).
- Because the Federal role in water programs is well-developed already in the Caribbean, it is concluded that a significant enlargement of this role is inappropriate. A Level B study has been proposed for Puerto Rico; no Level B studies are recommended for the Virgin Islands. In Puerto Rico, data collection and research are needed in various fields, especially regarding the inefficient management of irrigation water. The primary research needs in the Virgin Islands relate to water conservation methods, aquifer development and management, and water recycling. (For more details see the Caribbean Regional Report.)

Comparative Analysis

Table V-22 presents a comparison of the National Future (NF) and State-Regional Future (SRF) with regard to estimates of streamflows and water needs in the Caribbean Region.

National Future estimates of total withdrawals and consumption in 1975 are greater than those of the State-Regional Future. By the year 2000,

this situation is reversed with the SRF exceeding NF projections. Significant differences between NF and SRF values exist in the agricultural and domestic use categories. Commercial and minerals show good agreement in both withdrawal and consumption.

Table V-22

THE CARIBBEAN REGION
Socioeconomic and Volumetric Data Summary

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total Population	3,052	3,052	3,614	3,614	4,234	4,234
Total Employment	809	809	1,010	1,010	1,190	1,190
VOLUMETRIC DATA (mgd)						
-Mean Annual Conditions-						
Streamflow at Outflow Point(s)	4,851	667	4,807	NE	4,882	NE
Freshwater Withdrawals	908	725	963	901	888	1,086
Agriculture	521	239	498	229	330	232
Steam-Electric	0	0	0	0	0	0
Manufacturing	NE	101	NE	124	NE	133
Domestic	311	311	376	461	454	618
Commercial	44	44	52	52	60	60
Minerals	31	30	37	35	46	44
Public Lands	0	0	0	0	0	0
Fish Hatcheries	0	0	0	0	0	0
Other	0	0	0	0	0	0
Freshwater Consumption	343	299	374	368	299	427
Agriculture	281	147	297	154	206	163
Steam-Electric	0	0	0	0	0	0
Manufacturing	NE	25	NE	31	NE	33
Domestic	49	114	61	167	75	212
Commercial	9	9	11	11	13	13
Minerals	4	4	5	5	6	6
Public Lands	0	0	0	0	0	0
Fish Hatcheries	0	0	0	0	0	0
Other	0	0	0	0	0	0
Ground Water Withdrawals	254	254	NE	221	NE	241
Reservoir Evaporation	0	0	0	0	0	0
Instream Approximation						
Fish and Wildlife	3,706	3,706	3,706	3,706	3,706	3,706

Data table explanatory notes appear on the next page.

Socioeconomic and Volumetric Data Summary
Explanatory Notes

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SRF - State-Regional Future, the data estimates developed by state-regional entities to describe present and future trends according to state-regional goals and objectives.

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NA - Not Available. NA indicates that the functional use requirement is estimated as a portion of a different category. NA is used frequently under SRF commercial water use since many regions did not estimate "commercial" requirements separately but accounted for them under "domestic" withdrawals and consumption.

NE - Not Estimated. SRF "fish hatcheries" and "public lands" requirements are not estimated in many cases since these categories are not separately identified. These categories, however, may be accounted for under "other". SRF future streamflows are not estimated since the methodology was not available to the Regional Sponsors at the time the data was developed.

MGD - Millions of gallons per day.

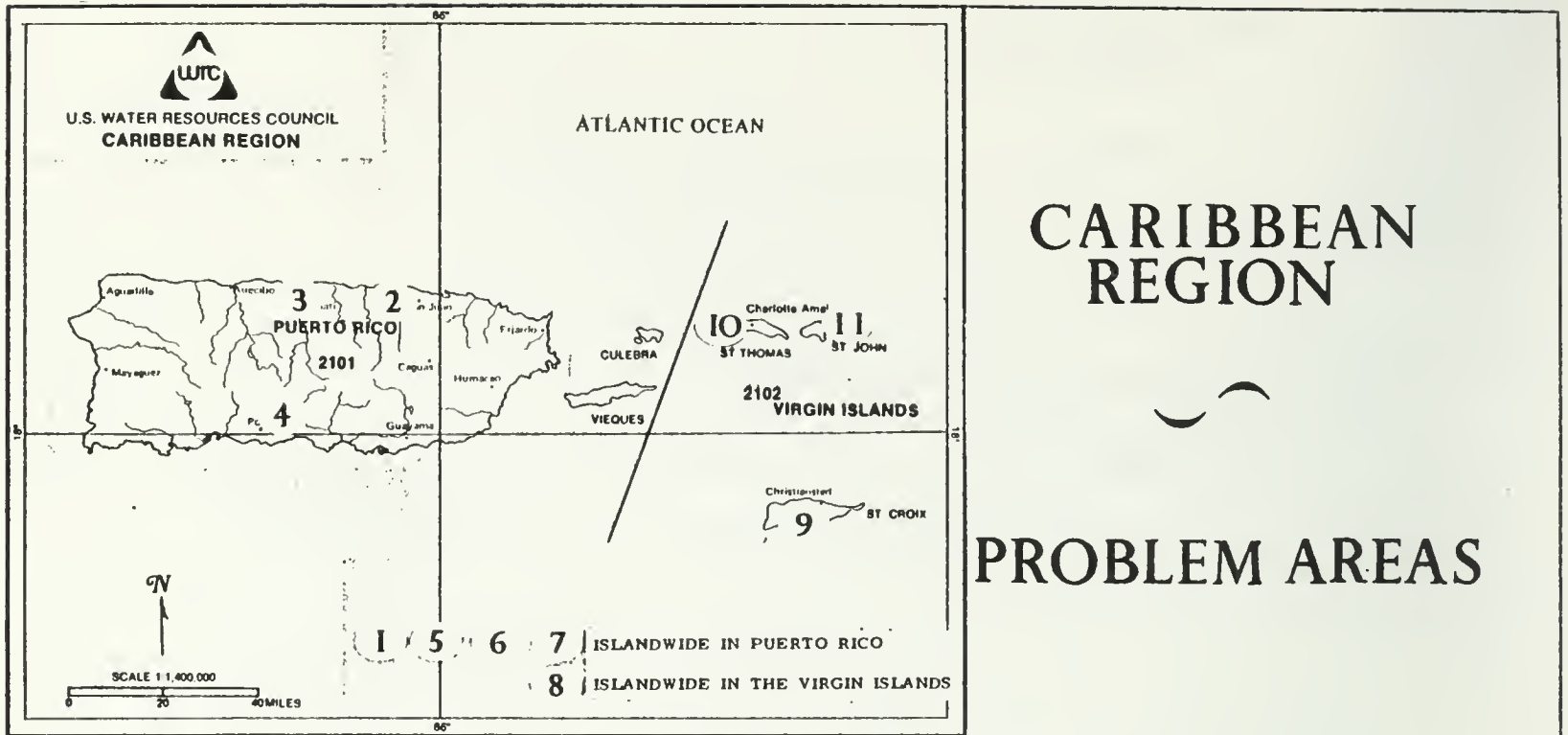
Mean Annual Conditions - Estimates based on average uses and average availability of water.

Agriculture - Includes livestock and irrigation requirements.

Domestic - Includes central and non-central systems.

Reservoir Evaporation - Estimates for reservoirs having a usable capacity of 5,000 acre-feet or more.

Instream Flow Approximations for Fish and Wildlife - NF estimates are based on judgmental estimates of streamflows required at subregional outflow points to maintain habitat for aquatic and riparian plants and animals.



CARIBBEAN REGION

PROBLEM AREAS

1. Institutional Problems (Puerto Rico)
2. San Juan Area (Puerto Rico)
3. Barceloneta Area (Puerto Rico)
4. South Coast Area (Puerto Rico)
5. Flooding (Puerto Rico)
6. Waterborne Pathogens (Puerto Rico)
7. Sedimentation and Eutrophication (Puerto Rico)
8. Institutional Problems (Virgin Islands)
9. St. Croix (Virgin Islands)
10. St. Thomas (Virgin Islands)
11. St. John (Virgin Islands)

FIGURE V- 62

O Problem Issues Identified by Federal Agency Representatives



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